Index

ENGINEERING-TRANSPORTATION
LIBRARY

THE UNIVERSITY
OF MICHIGAN
JAN 12 1967
ENGINEERING
LIBRARY

# NUCLEAR SCIENCE ABSTRACTS

Volume 20 Number 23

Abstracts 42696–45245

December 15, 1966

UNITED STATES ATOMIC ENERGY COMMISSION
Division of Technical Information

DEPOSITED BY THE
UNITED STATES OF AMERICA

# USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U. S. that are abstracted in *Nuclear Science Abstracts*.

**ALABAMA**
Auburn, Auburn University
**ALASKA**
College, University of Alaska
**ARIZONA**
Tucson, University of Arizona
**ARKANSAS**
Fayetteville, University of Arkansas
**CALIFORNIA**
Berkeley, University of California
Davis, University of California
Los Angeles, University of California
San Diego, Public Library
Stanford, Stanford University
**COLORADO**
Boulder, University of Colorado
Denver, Public Library
**CONNECTICUT**
New Haven, Yale University
**DELAWARE**
Newark, University of Delaware
**DISTRICT OF COLUMBIA**
Washington, Library of Congress
**FLORIDA**
Coral Gables, University of Miami
Gainesville, University of Florida
Tallahassee, The Florida State University
**GEORGIA**
Atlanta, Georgia Institute of Technology
**HAWAII**
Honolulu, University of Hawaii
**IDAHO**
Pocatello, Idaho State University
**ILLINOIS**
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois
**INDIANA**
Bloomington, Indiana University
Lafayette, Purdue University
**IOWA**
Ames, Iowa State University
**KANSAS**
Manhattan, Kansas State University
**KENTUCKY**
Lexington, University of Kentucky
Louisville, University of Louisville
**LOUISIANA**
Baton Rouge, Louisiana State University
New Orleans, Tulane University
**MARYLAND**
Baltimore, Johns Hopkins University
College Park, University of Maryland
**MASSACHUSETTS**
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology
**MICHIGAN**
Ann Arbor, University of Michigan
Detroit, Public Library
East Lansing, Michigan State University
**MINNESOTA**
Minneapolis, University of Minnesota
**MISSISSIPPI**
State College, Mississippi State University
**MISSOURI**
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University
**MONTANA**
Bozeman, Montana State College
**NEVADA**
Las Vegas, Nevada Southern University
Reno, University of Nevada
**NEW JERSEY**
Princeton, Princeton University
Teaneck, Fairleigh Dickinson University
**NEW MEXICO**
Albuquerque, University of New Mexico
**NEW YORK**
Albany, The University of the State of New York
Buffalo, State University of New York at Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, New York University
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute
**NORTH CAROLINA**
Charlotte, Public Library of Charlotte and Mecklenburg County
Durham, Duke University
Raleigh, North Carolina State College
**NORTH DAKOTA**
Grand Forks, University of North Dakota
**OHIO**
Cincinnati, University of Cincinnati
Cleveland, Public Library
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University
**OKLAHOMA**
Norman, University of Oklahoma
Stillwater, Oklahoma State University
**OREGON**
Corvallis, Oregon State University
Portland, Reed College
**PENNSYLVANIA**
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University
**PUERTO RICO**
Rio Piedras, University of Puerto Rico
**RHODE ISLAND**
Providence, Brown University
**SOUTH CAROLINA**
Columbia, University of South Carolina
**TENNESSEE**
Knoxville, University of Tennessee
Memphis, Public Library
Nashville, Joint University Libraries
Oak Ridge, Oak Ridge Associated Universities
**TEXAS**
Austin, University of Texas
College Station, Texas A & M University
Dallas, Southern Methodist University
Houston, Rice University
Lubbock, Texas Technological College
San Antonio, Public Library
**UTAH**
Salt Lake City, University of Utah
**VIRGINIA**
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia
Norfolk, Old Dominion College
**WASHINGTON**
Pullman, Washington State University
Seattle, University of Washington
**WEST VIRGINIA**
Morgantown, West Virginia University
**WISCONSIN**
Madison, University of Wisconsin
Milwaukee, Public Library
**WYOMING**
Laramie, University of Wyoming

DEPOSITED BY THE
UNITED STATES OF AMERICA

Volume 20, Number 23, December 15, 1966

# NUCLEAR SCIENCE ABSTRACTS

*A semimonthly publication of the USAEC Division of Technical Information, Edward J. Brunenkant, Director.*
*Published by the USAEC Division of Technical Information Extension, Robert L. Shannon, Extension Manager.*

*Nuclear Science Abstracts* covers the international literature on nuclear science and technology and provides the only comprehensive abstracting and indexing of this body of information. Published twice each month since 1947, *NSA* covers technical reports of the U. S. Atomic Energy Commission and its contractors, technical reports of U. S. Government agencies and other governments, universities, industrial and research organizations, as well as patents, books, and journal literature on a world-wide basis. Nearly 350,000 abstracts have appeared in *NSA* through Volume 19. The subject matter covered in *NSA* is described in issue Number 1 and in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37830.

Abstracts are arranged according to a number of subject categories and subcategories. Definitions of categories appear in issues Number 1 and 13. If the language of the original item is not English, the language will be indicated. Translations are not abstracted where an abstract of the original item has appeared in *NSA*.

## INDEXES TO NSA

Corporate author, personal author, subject, and report number indexes appear in each issue and are cumulated quarterly, semiannually, and annually. Multi-volume cumulations have been issued as indicated on the following page. Report number indexes for all volumes (1–18) were issued at the end of Vol. 18. At the end of Vol. 19, the indexes for Vols. 1–15 were reissued to include additional public availability information. This cumulation will be a permanent shelf item and will not be reissued. Report number indexes for Vol. 19 are included as a cumulation beginning with Vol. 16.

## AVAILABILITY OF PUBLICATIONS ABSTRACTED

The public availability of all U. S. Atomic Energy Commission reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations abstracted in *Dissertation Abstracts* and included in *NSA* are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan 48103.

Most of the published literature abstracted in *NSA* is on deposit at the Library, Oak Ridge Associated Universities, Oak Ridge, Tennessee, (a USAEC depository library) and is available through interlibrary loan. When requesting papers from this source, it is important that *NSA* volume and abstract number be cited.

# HOW TO OBTAIN NUCLEAR SCIENCE ABSTRACTS

*NSA* is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37830.

Government agencies may obtain *NSA* free of charge.

*NSA* is available to the general public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, as follows:

For the 24 regular issues, $30.00 domestic, $37.00 foreign. A single issue costs $1.75, plus 25 per cent for foreign mailing. Domestic rates apply to the United States, Canada, Mexico, and Central and South American countries except Argentina, Brazil, Guyana and French Guiana, Surinam, and British Honduras. Foreign rates apply to the countries excepted above and to all other countries throughout the world.

For the quarterly, semiannual, and annual indexes, $22.00 domestic, $25.00 foreign.

Multivolume subject and author indexes are available as follows:

Vols. 1–4 (1948–1950) Johnson Reprint Corporation, 111 Fifth Avenue, New York, N. Y. 10003, $30.00.

Vols. 5–10 (1951–1956) Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $5.25.

Vols. 11–15, Subjects, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $19.00.

Vols. 11–15, Personal Authors, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $14.25.

Vols. 11–15, Corporate Authors, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $2.50.

Cumulative Report Number Index, Vols. 1–15, Revised, is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $4.00.

Cumulative Report Number Index, Vols. 16–19, is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, $2.50.

Annual Indexes are available separately from the U. S. Government Printing Office as follows:

Vol. 16, Subject and Authors, $9.75.
Vol. 17, Subject and Authors, $12.25.
Vol. 18, Subject and Authors, $12.50.
Vol. 19, Subject and Authors, $12.50.

# ACKNOWLEDGMENTS

Agreements between the United States Atomic Energy Commission and the following organizations with regard to providing continuing services and specific literature coverage for *Nuclear Science Abstracts* are gratefully acknowledged:

American Institute of Physics; Atomic Energy of Canada Limited; Atomic Energy Research Establishment, United Kingdom; European Atomic Energy Community (EURATOM); Gmelin Institute; International Atomic Energy Agency; Japan Atomic Energy Bureau — Japan Atomic Energy Research Institute; Netherlands Patent Office; Reactor Centrum Nederland.

# TABLE OF CONTENTS

**Volume 20, Number 23, December 15, 1966**

*Category* *Page*

BIOLOGY AND MEDICINE . . . . . . 5209
  General . . . . . . . . . . . 5209
  Ecology . . . . . . . . . . . 5213
  Metabolism, Tissue Distribution, and Toxicology . . . . . . . 5214
  Radiation Effects on Biochemicals . . . 5223
  Radiation Effects on Tissues . . . . . 5227
  Radiation Effects Therapy and Countermeasures . . . . . . 5249
  Radiation Hazards and Protection . . . 5252
  Radiotherapy and Radiodiagnosis . . . . 5254

CHEMISTRY . . . . . . . . . 5261
  General . . . . . . . . . . 5261
  Analytical Procedures . . . . . . . 5261
  Inorganic and Physical Chemistry . . . 5272
  Organic Chemistry . . . . . . . 5285
  Radiation Chemistry . . . . . . . 5287
  Radiochemistry . . . . . . . . 5299
  Separation Processes and Procedures . . . 5303

ENGINEERING . . . . . . . . 5310
  General . . . . . . . . . 5310
  Applications of Nuclear Explosions . . . 5310
  Facilities and Equipment . . . . . 5311
  Heat Transfer and Fluid Flow . . . . 5312
  Materials Testing . . . . . . 5314
  Protective Structures . . . . . . 5315
  Space Propulsion . . . . . . . 5315
  Vacuum Engineering . . . . . . 5315

GEOLOGY, METEOROLOGY, AND MINERALOGY . . . . . . . 5317
  General . . . . . . . . . 5317
  Meteorology . . . . . . . . 5318
  Natural Radioactivity and Fallout . . . . 5318
  Site Survey and Selection . . . . . 5323
  Techniques and Equipment . . . . . 5323
  Thorium and Uranium Minerals . . . . 5325

HEALTH AND SAFETY . . . . . . . 5326

INSTRUMENTATION . . . . . . . 5335
  General . . . . . . . . . 5335
  Radiation Detection . . . . . . . 5338
  Radiation Effects . . . . . . . 5349

ISOTOPE TECHNOLOGY . . . . . . . 5351
  General . . . . . . . . . 5351
  Industrial Applications . . . . . . 5351
  Power Application . . . . . . . 5355
  Separation and Production . . . . . 5356

*Category* *Page*

MATHEMATICS AND COMPUTERS . . . . 5357

METALS, CERAMICS, AND OTHER MATERIALS . . . . . . . . 5358
  General . . . . . . . . . 5358
  Corrosion . . . . . . . . . 5360
  Fabrication . . . . . . . . . 5363
  Properties and Structure . . . . . 5367
  Radiation Effects . . . . . . . 5379

PHYSICS . . . . . . . . . 5385
  General . . . . . . . . . 5385
  Accelerators . . . . . . . . 5386
  Astrophysics and Cosmology . . . . . 5389
  Atomic Physics . . . . . . . 5393
  Cosmic Radiation . . . . . . . 5398
  Direct Energy Conversion . . . . . 5400
  Elementary Particles and Radiations . . . 5401
  Field Theory, Scattering Theory, and Symmetries . . . . . . . 5410
  Fluid Physics and Thermodynamics . . . 5421
  Geophysics . . . . . . . . 5422
  Gravitation, Quantum Mechanics, and Relativity Theory . . . . . . 5431
  Low Temperature Physics . . . . . 5433
  Neutron Physics . . . . . . . 5440
  Nuclear Properties and Reactions . . . 5443
  Plasma Physics and Thermonuclear Processes . . . . . . . 5466
  Shielding . . . . . . . . . 5483
  Solid State Physics . . . . . . 5483

REACTOR TECHNOLOGY . . . . . . 5490
  General . . . . . . . . . 5490
  Auxiliaries and Components . . . . 5491
  Criticality Studies . . . . . . 5492
  Fuels . . . . . . . . . . 5496
  Power and Power-Breeder Reactors . . . 5497
  Process Heat Reactors . . . . . . 5505
  Production Reactors . . . . . . 5505
  Propulsion and Space . . . . . . 5506
  Research and Test Reactors . . . . . 5507

WASTE DISPOSAL AND PROCESSING . . . 5509

GENERAL AND MISCELLANEOUS . . . . 5513

CORPORATE AUTHOR INDEX . . . . INDEX-1

PERSONAL AUTHOR INDEX . . . . INDEX-12

SUBJECT INDEX . . . . . . . INDEX-70

REPORT NUMBER INDEX . . . . INDEX-184

# STAFF OF NUCLEAR SCIENCE ABSTRACTS

**MANAGING EDITOR**

John W. Norris

**ASSISTANT MANAGING EDITOR**

Donald D. Davis

**ASSOCIATE EDITORS**

Lawrence T. Whitehead
David E. Bost
Robert C. Kelly
Lee M. Thompson

**SUBJECT INDEX EDITOR**

Everett J. Hoffman

**EVALUATORS**

William D. Matheny
John H. Mitchell
Mary H. Newman

**ABSTRACTORS**

F. S. Armstrong (AECL)
Jane G. Buchanan
D. Lamar Cason
Bennie G. Di Bona
Helen G. Donald
James R. Dulaney
Wells L. Green
Mary Catherine Grissom
Fernando J. Hamilton
Phyllis C. Hansen
Carolyn D. Houston
Rose V. Jermain
Betty L. McDowell
Jean F. Peckham
Mona H. Raridon
Julia S. Redford
Francis L. Sachs
Lila B. Smith
Charles E. Stuber
Martha J. Thomas
Anne G. Ward
David C. West
Milton O. Whitson
Gabriel O. Ycaza

**SUBJECT HEADING SPECIALIST**

Robert E. Upchurch

**DESCRIPTIVE CATALOGING SPECIALIST**

J. Paul Meredith

**CORPORATE AUTHOR SPECIALIST**

Clara L. Fox

**SCHEDULING AND PUBLISHING COORDINATOR**

Brainard L. Patton

**Communication concerning the editorial policy and content of *NSA* should be addressed to the Managing Editor, *Nuclear Science Abstracts*, AEC Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37830.**

---

***Use of funds for printing this publication approved by the Director of the Bureau of the Budget, June 28, 1966.***

A-30 - O.P. 0420

Volume 20, Number 23 December 15, 1966

NUCLEAR SCIENCE ABSTRACTS

# BIOLOGY AND MEDICINE

## General

*Refer also to abstracts 43118 and 43138.*

**42696** (ABCC-0-65) BIBLIOGRAPHY OF PUBLISHED PAPERS OF THE ATOMIC BOMB CASUALTY COMMISSION. **(Atomic Bomb Casualty Commission, Hiroshima (Japan)).** 1965. **Contract AT(49-1)-Gen-72. 7p.** Dep. mn. CFSTI **$1.00 cy, $0.50 mn.**

A list of 43 publications are presented on: aging, growth *in utero*, mortality, and pathological studies of atomic bomb survivors; and basic research in angiology, encephalopathy, diabetes, genetics, hematologic disease, pediatrics, radiology, tuberculosis, and urinary disease. Author and subject indexes are included. (H.G.D.)

**42697** (ABCC-18-65) MORTALITY, 1950-64, AND DISEASE AND SURVIVORSHIP, 1958-64, AMONG SAMPLE MEMBERS AGED 50 YEARS OR OLDER, 1 OCTOBER, 1950. Ciocco, Antonio (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Contract AT(49-1)-Gen-72. 53p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Mortality and the occurrence of selected diseases subsequent to 1950 were studied in atomic bomb survivors 45 years of age or older at the time of the blast. Three exposure groups were compared: persons within 1400 m of the hypocenter; those beyond 1400 m; and persons not in the city at the time of the blast. Each group was examined for: cumulative mortality pattern from October 1, 1950 to September 30, 1964, for all causes of death, and for deaths from tuberculosis, lung cancer, stomach cancer, and leukemia; occupational characteristics and their relation to mortality; prevalence, incidence, and survival of tuberculosis among participants in the study; and factors affecting the frequency of autopsy. A new model approach to survival time analysis is presented. (H.G.D.)

**42698** (ANL-7136, pp 80-94) THEORETICAL BIOLOGY. (Argonne National Lab., Ill.).

An integrated theory was developed for use in estimating the distribution of sizes of particulate matter from plane sections. Applications in estimations of the frequency of size distributions of spheres of varying radii randomly embedded in an opaque cube from a planar cut section are described. An iterative process for obtaining optimum allocation of the total sample size to the various strata with minimum variance while restricting the strata sample size was developed that used a stratified sampling design. Possible applications in theoretical biology or capital budgeting in an argonization that has a hierarchy are discussed. The stochastic aspects inherently connected with the occurrence of mortality in large populations were studied by means of a Monte Carlo program using a model provided by an ensemble of particles in Brownian motion inside a potential well, with escape of particles from the well corresponding to death of an individual member of the population. A mathematical procedure is described for the specification and quantitation of the constituency in a radioactive mixture from count rate data. The procedure is based on the assumption that the nuclides present in the mixture are included in a selected list of candidates. A two-part computer program in FORTRAN was constructed to facilitate computations of counting data and satisfy storage limitations of a medium-speed electronic computer. Preliminary work on the computer simulation of granulocyte kinetics and application of the empirical Bayes approach to the two-action problem are discussed. A system of computer programs to retrieve and display a large quantity of biological data is described. The computer languages, FORTRAN and VFAP, in conjunction with the FORWARD SORT/MERGE GENERATOR of a GE 225 computer were used to retrieve and organize qualitative and quantitative data from necropsy records as an aid in determining the cause of death of individuals in a large dog colony. Applications of computers in other biological studies are discussed briefly. (C.H.)

**42699** (ANL-7136, pp 94-108) LABORATORY ANIMAL MEDICINE. (Argonne National Lab., Ill.).

Progress is reported in the development of methods for the care, management, and disease control in laboratory animals. Data are included on the disease status of commercial mice, the rodent breeding program, and the diagnosis, pathology, and control of *Pseudomonas aeruginosa*, Salmonella, and *Citrobacter freundii*, and other intestinal microflora infections in laboratory mice. (C.H.)

**42700** (ANL-7136, pp 162-3) EPIDEMIOLOGICAL STUDIES IN HUMAN POPULATIONS. (Argonne National Lab., Ill.).

Progress is reported in an epidemiological study, based on published vital statistics and data on uranium ore reserves, on populations of Colorado residing at altitudes ranging from 3000 to 11,000 ft. The 180,000 birth certificate data cards for the state for the years 1959 through 1962 were programmed on an IBM 704 computer to analyze the relation of average birth weight to certain variables, including altitude of maternal residence, sex of the infant, maternal age, and length of pregnancy. The findings are summarized. (C.H.)

**42701** (ANL-7136, pp 205-30) STUDIES IN CELLULAR FINE STRUCTURE. (Argonne National Lab., Ill.).

The origin of DNA (nuclear or cytoplasmic) incorporated into cytoplasmic organelles of various cell lines (paramecium, Tetrahymena, bacteria) was investigated by means of kinetic studies of $^3$H-thymidine labeling of organelles at various time intervals following division. Tritium conversion was measured directly with a windowless Geiger counter and electron microscopic autoradiography was used to measure pulse labeling of DNA. Tritium given in thymidine was conserved without significant loss within a given cell lineage for at least seven fission generations. The label was entirely absent from the cytoplasmic trichocysts for one generation following its administration but considerable concentrations were found on trichocysts late in $f_1$ and early $f_2$ and the trichocyst label appeared to represent RNA as well as DNA. Results are included from studies on the fine structure of the flagellate, Cyathomonas truncata, Chlorella, the herbivorous giant amoeba, Pelomyxa palustris, and Tetrahymena ciliates. Procedures used for the preparation of cells for electron microscopy and electron microscopic autoradiography are described. (C.H.)

**42702** (ANL-7136, pp 243-55) CELLULAR BIOCHEMISTRY. (Argonne National Lab., Ill.).

Progress is reported on studies on the action of ribonuclease on yeast cells and spheroplasts; studies on nuclear proteins; studies on rat liver ribonucleases; the control of ribosome synthesis in bacteria; studies on the cytoplasmic granules in Saccharomyces cerevisiae during sporulation; studies on lipids of Enterobacter cloacae; and investigations of ultraviolet microscopy as a tool for cytological and biochemical research. (C.H.)

**42703** (ANL-7136, pp 302-14) GROWTH AND DEVELOPMENT OF PLANTS IN COMPENSATED GRAVITATIONAL, MAGNETIC, AND ELECTRICAL FIELDS. (Argonne National Lab., Ill.).

Progress is reported on studies on the development of plants in compensated gravitational, magnetic, and electrical fields. The results provide information on the nature of the gravitational sensor that is pertinent to the programming of biosatellite motion. Data are presented from studies on effects of centrifugal force direction on the growth of roots and shoots of compensated oat (Avena sativa) seedlings; changes occurring at morphological, physiological, and biochemical levels of organization in gravity-compensated Avena seedlings in which it was demonstrated that the mechanical motion involved in compensation can impair phototropic sensitivity of plants while compensation per se enhances phototropism when the references is the tropism of plants grown under approximately the same motional vectors but without compensation; the effects of various gravity treatments on the percent of seed germination and number of roots per plant of Avena seedlings; the role of auxin in the geotropism of compensated Avena seedlings; and auxin transport in vertically and horizontally oriented coleoptile segments of corn (Zea mays) under aerobic and anaerobic conditions. (C.H.)

**42704** (BNL-967) GENETIC TOBACCO TUMORS AND THE PROBLEM OF DIFFERENTIATION. Smith, Harold H. (Brookhaven National Lab., Upton, N. Y.). Dec. 15, 1965. Contract AT-30-2-GEN-16. 11p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Brookhaven Lecture Series No. 52.

The following tenuous or firm conclusions were drawn. Tumor-forming Nicotiana species hybrids comprise genetic systems that control a precarious balance between normal and tumorous development as a consequence of bringing together two evolutionarily divergent, nonintegrated genotypes. The basic factors controlling tumor formation in these hybrids are genes located in the chromosomes. Tumor induction depends primarily on the accumulation of greater than regulatory amounts of growth-promoting substances. These substances regulate cell division and enlargement, and differentiation as well, by controlling gene activity. They act on nucleic acid systems of DNA-dependent RNA synthesis to govern the supply of proteins, enzymes, or enzyme systems limiting to growth and differentiation. The genetically tumor-conditioned hybrids of Nicotiana provide favorable material for studying relationships between normal differentiation and tumor formation in that the systems can be readily manipulated under controlled experimental conditions. Hypothetical gene activation circuits which relate regulator-operon systems to phytohormone production and cell division are suggested. (45 references.) (auth)

**42705** (BNL-10405) PROPERTIES OF THE HEMOPOIETIC STEM CELL: CAN ITS BONE MARROW REPOPULATING ABILITY BE DISSOCIATED FROM IMMUNOLOGICAL COMPETENCE. Cronkite, Eugene P. (Brookhaven National Lab., Upton, N. Y.). May 1966. Contract AT (30-2)-Gen-16. 13p. (CONF-660543-3). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Conference on Effects of Various Types of Ionizing Radiations from Different Sources on the Hematopoietic Tissue, Vienna.

A knowledge of stem cell properties is vital to understanding spontaneous marrow recovery and how recovery is induced by marrow transplantation. To this end, progress is reported on research concerning: time parameters of marrow proliferation in man; properties of stem cells, and the possibility of selectively eliminating immunologically competent cells from bone marrow to prevent a theoretically totipotent cell from producing immunologically competent cells. (H.G.D.)

**42706** (NYO-2373-1) PROGRESS REPORT [ON BOTANY], FEBRUARY 1965-FEBRUARY 1966. (Smithsonian Institution, Washington, D. C.). Contract AT (30-1)-2373. 69p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Research progress is reported on: amino acid incorporation into protein by a chloroplast-containing fraction from bean leaf homogenate; photomorphogenesis in plants and light-accelerated utilization of carbohydrates; time rate of change in spectral distribution of total sky irradiance; and cytological studies of radioinduced chromosomal aberration in Tradescantia. (H.G.D.)

**42707** (RLO-581-10) STUDIES OF GENETIC ALTERATIONS IN HUMAN CELLS AND MOLECULES AND THE FACTORS INFLUENCING THEM. Progress Report, August 1, 1965-July 31, 1966. Rigas, Demetrios A.; Goldman, Robert D. (Oregon Univ., Portland. Div. of Experimental Medicine). Contract AT(45-1)-581. 38p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Separate abstracts were prepared on the two sections of this report. (C.H.)

*For abstracts of individual sections see: 43014 and 43272.*

**42708** (TID-22931) PROGRESS REPORT [ON LEUKOPOIETIC ACTIVITY], MARCH 1, 1965-APRIL 30, 1966. Bierman, Howard R. (Loma Linda Univ., Los Angeles, Calif. Inst. for Cancer and Blood Research). Contract AT(04-3)-455. 22p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Progress is reported on studies of substances that stimulate granulocytopoiesis and substances that cause an increase in the number of circulating leukocytes in blood. Data are reviewed that indicate that leukocytes are tissue cells rather than blood cells in the sense of erythrocytes and factors involved in leukopoietic regulation may be derived from non-hematopoietic tissues. The majority of leukocytes reside in tissues or marginate in the capillaries, and the effects of leukopoietins on leukopoiesis and the release of leukocytes from the non-circulating reservoirs into the circulation are discussed. Criteria for the demonstration of leukopoietic enhancing ability are presented. Application of a spleen colonization assay method for the detection of leukopoietic activity in mice and a method for the extraction of a leukopoiesis-stimulating factor from bovine kidney are described. The leukopoiesis-stimulating activity of saline extracts of bovine kidney was demonstrated by observations on colony formation in the spleen of normal, irradiated, and endoxin treated mice. (23 references). (C.H.)

**42709** (TID-23233) X-AUTOSOMAL TRANSLOCATIONS OF DROSOPHILA MELANOGASTER. Final Report. Warters, Mary (Centenary Coll., Shreveport, La. Dept. of Biology). [1966]. Contract AT(40-1)-2729. 12p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Studies on Drosophila melanogaster were aimed at developing a technique that would make possible the recovery of all X;autosomal translocations and the maintenance of them as a balanced stock. Further a cytological analysis of a representative sample of X;autosomal translocations was made in an effort to determine the difference between those that were male fertile and those that were male sterile. Using the procedure of Lindsley, 274 translocations were found from 2188 tested genomes distributed in classes T(X;2), T(X;3), T(X;2;3), and T(2;3). Sex-linked recessive lethals suppressed by the Y chromosome were analyzed and are presented in tabular form. Differences between male fertile and male sterile translocations were established cytologically. With the exception of a few very complex rearrangements, the exact breakpoints as lettered subdivisions and the new chromosome sequence of each was determined, and analyzed in terms of heterochromatin and euchromatin. (H.G.D.)

**42710** (TID-23348) PATHOLOGY OF DIRECT AIR-BLAST INJURY. Technical Progress Report. Chiffelle, Thomas L. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.). Apr. 1966. Contract AT(29-1)-1242. 53p. (DASA-1778; AD-637212). CFSTI $3.00 cy, $0.50 mn.

Blast injury is a complex and very hazardous phenomenon to the biologic target. Together with effects of thermal radiations from modern nuclear weapons, blast injury (direct and indirect) appears to be accountable for the vast bulk of early deaths and casualties in nuclear explosions. The important clinical, physiological, and pathological information concerning the effects of direct air-blast injury on the biologic subject are summarized. Certain features have been emphasized in order to assist the clinical medical officer towards proper management of casualties. A brief description of pulmonary sequelae of blast injury is included for completeness. (auth)

**42711** (UCRL-16246) BIOLOGY AND MEDICINE SEMIANNUAL REPORT, SPRING 1965. Lawrence, John H. (ed.) (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion). Contract W-7405-eng-48. 190p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Progress is reported on 19 projects. Separate abstracts were prepared for 14. The five remaining projects were reported in NSA as: 19: 36054 and 45968 and 20: 7411, 7418, and 8763. (H.G.D.)

*For abstracts of individual sections see: 42712–42717, 42744, 42745, 42858, 42859, 43015–43017, and 43637.*

**42712** (UCRL-16246, pp 51-7) VIRUS PARTICLES ASSOCIATED WITH IMMUNE RESPONSES IN EHRLICH ASCITES TUMOR CELLS. Barr, Josephine L.; Hayes, Thomas L. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

Morphological characteristics of two sublines of Ehrlich ascites tumor cells were examined with the electron microscope. Accumulations of virus particles were found at the cell surface of Type A cells in regions near the poles. The particles were of a size roughly compatible with the size of the antigenic material, as shown by filtration data. No such particles were seen on the surface of Type B cells, a subline that has no antigenic material of this size range. It is suggested, therefore, that the antigenic materials in Type A cells are virus particles. (H.G.D.)

**42713** (UCRL-16246, pp 107-18) RESPONSIVENESS OF HEMATOPOIETIC TISSUE TO ERYTHROPOIETIN IN RELATION TO THE TIME OF ADMINISTRATION AND DURATION OF ACTION OF THE HORMONE. Schooley, John C. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

Changes in the responsiveness of the stem-cell population were measured in hypertransfused mice after erythropoietin stimulation. Erythropoietin was injected at varying time intervals prior to injection of $^{59}$Fe-labeled iron citrate. Following the injection of erythropoietin, either in a single large dose or in multiple doses, a change in the responsiveness of the hematopoietic tissue occurs. The fact that different doses of erythropoietin stimulate erythropoiesis to the same extent when the action of the hormone is limited to 6 hr by the injection of antibody indicates that the stem cells are receptive to the action of erythropoietin only at some limited time in their individual life cycle. It is suggested that this period is sometime after metaphase and before the commencement of DNA synthesis in the interphase state of individual stem cells. Results further imply that the increased responsiveness of the hematopoietic tissue to erythropoietin following injection is due to recruitment of stem cells into this receptive state. This recruitment may be due to both the division of stem cells and the movement of cells through cell cycle into the receptive state. The results are discussed in relation to two recent models of stem-cell kinetics. (H.G.D.)

**42714** (UCRL-16246, pp 119-25) MICROELECTROPHORETIC AND ENZYMATIC STUDIES CONCERNING THE CARBOHYDRATE AT THE SURFACE OF RAT ERYTHROCYTES. Glaeser, Robert M.; Mel, Howard C. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

A combined microelectrophoretic and biochemical study pertinent to carbohydrate constituents at the surface of rat erythrocytes is reported. The negative electrophoretic mobility of rat erythrocytes is reduced when these cells are incubated with bacterial α-amylase, indicating that the surface charge of the cells has been reduced by the action of this enzyme. Release of sialic acid in a bound form results from the enzymatic treatment. The α-amylase-treated cells also exhibit stickiness and adhesion, whereas the untreated cells do not. These alterations in surface properties are believed to be associated with the enzymatic cleavage of a sialic acid-containing oligosaccharide, probably located at the outermost portion of the erythrocyte surface. The possible role of surface carbohydrate on mammalian cells is discussed. (H.G.D.)

**42715** (UCRL-16246, pp 145-55) SINGLE-STRAND BREAKS IN DUPLEX DNA OF COLIPHAGE T7 AS DEMONSTRATED BY ELECTRON MICROSCOPY. Freifelder, David; Kleinschmidt, Albrecht K. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

Previous work based on ultracentrifugal studies had led to the hypothesis that there are gaps in the single polynucleotide strands of the DNA of coliphage T7. To investigate this further, the length distribution of the single strands derived from native T7 DNA by alkaline denaturation was obtained. An improved technique for electron microscopic visualization of single strands of DNA in a cytochrome C monolayer was used for this measurement. In contrast with the narrow length distribution for native, double-stranded DNA, the length distribution of the single strands was found to be very broad (about eight-fold greater than for the native material). Single-stranded T7 DNA was then fractionated according to sedimentation coefficient by sucrose gradient centrifugation, and these various fractions were examined with the electron microscope. It was found that the more rapidly and slowly moving fractions consist of longer and shorter filaments, respectively, from which it has been concluded that sedimentation heterogeneity of single-stranded DNA is a reflection of molecular weight heterogeneity. Hence, the electron microscopic studies confirm the original hypothesis that T7 DNA contains single-strand breaks. An attempt was made to determine the position of these breaks and the number per molecule; however, it could be said that the breaks can occur in many places and that the number per molecule is small. (auth)

**42716** (UCRL-16246, pp 164-7) A TECHNIQUE FOR STARVATION OF E. COLI OF THYMINE. Freifelder, David (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

Experiments are reported that suggest that utilization of thymine pools by E. coli B/r (ATCC 12407) can be stopped by the addition of 50 μg/ml of any riboside. When thymidine replaces thymine, death is totally inhibited by 0.03 μg/ml; however, neither free bases, ribosides, nor deoxyribosides, separately at 100 μg/ml each, or in groups of four can antagonize low thymidine protection. (H.G.D.)

**42717** (UCRL-16246, pp 176-85) PARTICLE-SIZE DISTRIBUTION OF VERY LOW-DENSITY PLASMA LIPOPROTEINS. Hayes, Thomas L.; Lindgren, Frank T.;

Hawkins, James N.; Ewing, Alicia M.; Bierman, Edwin L. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

The size distributions of electrophoretically isolated subfractions of the very low-density human plasma lipoproteins were determined, using electron microscopic techniques. By this method, the primary and secondary particles show size distributions that are essentially the same. Very low-density lipoproteins produced by corn-oil feeding can be fixed by osmium tetroxide reaction whereas those produced by butterfat feeding could not be fixed or visualized by this technique. Evidence is presented that shows a good agreement between particle size as measured by electron microscopy and particle size as predicted by ultracentrifugal analysis. (auth)

**42718** (UR-49-687) BRIEF DESCRIPTION OF RESEARCH PUBLISHED DURING 1965. Annual Report. Neuman, William F.; Rothstein, Aser (Rochester Univ., N. Y. Atomic Energy Project). July 1, 1966. Contract W-7410-eng-49. 250p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

Separate abstracts were prepared on seven sections of this report. (C.H.)

*For abstracts of individual sections see: 42719, 42720, 42746, 42747, 42860, 43591, and 45244.*

**42719** (UR-49-687, pp 117-31) MOLECULAR AND CELLULAR LEVEL STUDIES. (Rochester Univ., N. Y. Atomic Energy Project).

Abstracts are presented on 9 publications during 1965 on cytological and molecular studies. Bibliographic information is included. (C.H.)

**42720** (UR-49-687, pp 177-94) CANCER RESEARCH. (Rochester Univ., N. Y. Atomic Energy Project).

Abstracts are presented on 8 publications during 1965 on various aspects of cancer research. Bibliographic information is included. (C.H.)

**42721** FORMATION OF CIRCULAR DNA AFTER LYSOGENIC INDUCTION. Lipton, Allan; Weissbach, Arthur (National Inst. of Arthritis and Metabolic Diseases, Bethesda, Md.). Biochem. Biophys. Res. Commun., 23: 436-41(May 25, 1966).

Experiments are reported that demonstrate the formation of a circular DNA species after lysogenic induction of *E. coli* K12 λ and show it to have characteristics similar to those of the circular DNA formed from λ phage DNA immediately after infection. The appearance of circular λ DNA 45 min after lysogenic induction coincides with the onset of DNA synthesis. Amount of the new DNA species detected at any one time did not exceed 1 to 2% of the total DNA synthesized. (H.G.D.)

**42722** TRITIUM-LABELED CARDIAC GLYCOSIDES: DIGOXIN-$12^{\alpha}$-$^3$H. Wartburg, A. V.; Kalberer, F.; Rutschmann, J. (Sandoz Ltd., Basel). Biochem. Pharmacol., 14: 1883-9(Dec. 1965).

Some problems in the preparation of $^3$H-labeled cardiac glycosides are discussed and a method of synthesizing $^3$H-digoxin in which some difficulties have been overcome or lessened is reported. Three ways of preparing radioactively labeled natural substances are considered: biosynthesis by intact plants or by parts of plants with the aid of a labeled precursor, exchange labeling with $^3H_2$ by the Wilzbach method or with the aid of catalysts, and introduction of $^{14}$C or $^3$H by partial synthesis. The first two methods have several disadvantages which are discussed. Because of unsatisfactory experiments with the Wilzbach method, a procedure was developed permitting the introduction of the tracer into a specific position of a representative cardiac glycoside. This was accomplished, as described in detail, by reacting tetra-*o*-acetyl-12-dehydrodigoxin with $NaBT_4$ and saponifying the reaction product to digoxin-12α-$^3$H. This synthesis avoids the formation of highly active impurities, and the sp act. of the product is limited, in principle, only by that of the reducing agent. As starting material, acetyldigoxin-α was used, which is readily obtainable by the enzymatic degradation of lanatoside C. Under suitable conditions acetyldigoxin-α is selectively oxidized by chromic acid in acetic acid, the sugar chain remaining largely intact. When the product 12-dehydro-acetyldigoxin-α was reacted with acetic anhydride in pyridine, a mixture of tri- and tetra-*o*-acetyl-12-dehydrodigoxin was obtained. This was first reduced with $NaBT_4$ and then treated with $NaBH_4$. The product so obtained was subjected to gentle deacetylation with dilute sodium carbonate solution in methanol and was then chromatographed on silica gel. After crystallization of the appropriate fractions from 75% ethanol, chemically and radiochemically homogeneous digoxin-12α-$^3$H was obtained. The product was identical in all its chemical properties with an inactive test substance of highest purity. The sp act. was 50 mC/mM. (BBB)

**42723** RADIOISOTOPES IN VETERINARY MEDICINE. Kallfelz, F. A.; Wasserman, R. H. (New York State Veterinary Coll., Ithaca, N. Y.). Isotop. Radiat. Technol., 3: 382-3(Summer 1966).

Uses of radioisotopes investigated at the New York Veterinary College are reviewed. Diagnostic uses include $^{131}$I for determining thyroid and liver function, $^{59}$Fe for determining parasitic blood loss, and $^{203}$Hg for locating brain tumors; therapeutic uses include $^{90}$Sr for treating tumors. (auth)

**42724** FIRST EFFICIENT CHEMOSTERILANTS AGAINST SCREW-WORM FLIES (DIPTERA: CALLIPHORIDAE). Crystal, Maxwell M. (Dept. of Agriculture, Mission, Tex.). J. Med. Entomol., 2: 317-19(Sept. 1965).

The effectiveness of chemical agents and ionizing radiation in sterilizing male screw-worm flies was compared. In mating tests, the degree to which males treated with chemosterilants competed with normal males was compared with that of males treated with radiation. The chemicals were administered to 1-day-old males. About 8000 R of γ radiation from a $^{60}$Co source was applied to other flies as 5.5-day-old pupae. Hatchability results of these tests are shown. Survival of chemically treated or irradiated males at 1 week was at least 85% of survival of control flies. There were no important differences in survival between chemically treated and irradiated males. Two compounds were each equal to radiation in effectiveness. A third compound was far superior to radiation at any ratio of treated and untreated males. Thus, *Cochliomyia hominivorax* sexually sterilized by bis(1-aziridinyl)-(hexahydro-1*H*-azepin-1-yl)phosphine oxide, 1-[bis(1-aziridinyl)phosphinyl]-3-(3,4-dichlorophenyl)urea, or γ-radiation, competed for mates about equally with normal males. Males sterilized by *N*,*N*′-tetramethylene-bis(1-aziridinecarboxamide) surpassed normal or radiosterilized males in mating competitiveness by a factor of at least four. (BBB)

**42725** PERMEABILITY TO WATER OF BIOMOLECULAR LIPID MEMBRANES. Hanai, T.; Haydon, D. A. (Cambridge Univ., Eng.). J. Theoret. Biol., 11: 370-82 (Aug. 1966).

The permeability to water and deuterium oxide of bimolecular lipid membranes was measured by an osmotic flow method. Sodium chloride, sucrose, and urea were used as the solutes in various concentrations and concentration differences. Under these conditions the lipid bimolecular films appeared to behave as semipermeable membranes and showed a constant permeability to water of approximately $1.9 \times 10^{-3}$ cm/sec. It is shown that the results can be accounted for semi-quantitatively in terms of a simple model. (auth)

**42726** FORMATION OF BIOLOGICALLY IMPORTANT "MONOMERS" USING IONIZING RADIATIONS. I. PRODUCTION OF S-CONTAINING AMINO ACIDS AND RELATED COMPOUNDS. Choughuley, Ahmed S. U.; Lemmon, Richard M. (Atomic Energy Establishment, Trombay, India. Univ. of California, Berkeley). pp 146-50 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A search was made for the "primitive Earth atmosphere" synthesis of S-containing amino acids using $H_2{}^{35}S$ as one of the reactants. Cysteic acid and the closely related compounds of taurine and cystamine were found, but an intensive search failed to indicate yields above 0.001% for cystine, cysteine, and methione. Adequate evidence was also lacking for the synthesis of homocysteine and homocysteic acid. (P.C.S.)

**42727** FOOD PRESERVATION PROBLEMS IN DEVELOPING COUNTRIES. Goldblith, S. A. (Massachusetts Inst. of Tech., Cambridge). pp 9-17 of STI-DOC-10/54.

The basic problems relating to food preservation in developing countries and the relative importance of these problems among the whole group of basic socio-economic problems of the world today are discussed. Statistics are presented (using the USA as an example of a well-developed country) on the importance of technology in the production and preservation of foods. The food preservation problems of the developing countries are outlined in a general manner with specific illustrations of the problems themselves and the magnitude of these problems. (C.H.)

**42728** THE EFFECTS OF RIBONUCLEASE AND DEOXYRIBONUCLEASE ON L-GLUTAMIC ACID (U)$^{14}$C AND METHIONINE $^{35}$S UPTAKE IN EHRLICH'S ASCITIC CARCINOMA TUMOURAL CELLS. Soru, E.; Banu, I.; Lazarescu, M.; Licurici, V. Stud. Cercet. Med. Interna, 6: 413-20(1965). (In Rumanian).

Preliminary studies are being made on inhibitory effects of ribonuclease and deoxyribonuclease on the development of Ehrlich's ascitic carcinoma, as well as the subsequent morphological changes. The present study deals with the influence of ribonuclease and deoxyribonuclease on certain biochemical constituents of Ehrlich's ascitic carcinoma tumor cells. Results of the effect of these enzymes on the L-glutamic acid (U)$^{14}$C and methionine $^{35}$S uptake in the proteins isolated from tissues of Ehrlich's ascitic carcinoma-bearing mice are reported. Both enzymes are inhibiting total protein uptake of methionine $^{35}$S in vitro. This effect is stronger with deoxyribonuclease than with ribonuclease. Both enzymes decrease the acid-soluble fraction uptake of the L-glutamic acid (U)$^{14}$C. In addition, the development of Ehrlich's ascitic carcinoma is inhibited by these enzymes. (tr-auth)

**42729** LEUKEMIC RETICULOSIS AND ALLIED DISORDERS. Fukuda, Takao (Tohoku Univ., Sendai). Tohoku J. Exp. Med., 87: 1-34(Oct. 1965).

To define the concepts of leukemic reticulosis and leukemic reticulosarcomatosis conditions and pathological characteristics, histological sections and blood films were investigated in 39 cases, which showed reticulum cells appearing in the peripheral blood. Leukemic reticulosis progressed rapidly and led to the death of patients within four months. Histological features were characterized by diffuse medullary reticulosis of the lymph nodes and diffuse reticulum cell infiltration in various organs. Leukemic reticulosarcomatosis is defined as hematogenous tumor cell dissemination of undifferentiated or reticular type reticulosarcoma at the terminal stage or as one of the results of chemotherapy or x-irradiation. Even in Hodgkin's disease a disease-like granulomatous reticulosis, reticulum cells were observed in blood films, but these changes were regarded as cataplastic in nature. In various reactive reticulosis, reticulum cells were observed in blood films. In association with various leukemias, reactive reticulosis exhibited malignant transition, and neoplastic reticulum cells appeared in peripheral blood at the terminal stage. (auth)

**42730** CONTINUED IMMUNOLOGICAL TOLERANCE IN MICE, INDEPENDENT OF ANTIGEN EXCESS. Zaalberg, O. B.; van der Meul, V. A. (National Defence Research Organization TNO, Rijswijk, Netherlands). Transplantation, 4: 274-92(May 1966).

The specific immunological tolerance of donor cells towards the host tissue antigens in allogeneic mouse irradiation chimeras was investigated. It was shown that transfer of bone marrow cells from these chimeras into irradiated mice of the original bone marrow-donor strain results in a loss of tolerance. However, transfer of spleen cells or bone marrow cells together with lymph node cells results in a prolonged state of tolerance towards the tissue antigens of the first host, as could be demonstrated with skin-grafts. These transfer experiments make it probable that for the maintenance of the tolerance within the lymphatic cell population no antigens are necessary. Mice inoculated with a tolerant lymphatic cell population gradually lose their tolerant state, the loss being ascribed to a gradual replacement of the tolerant population by nontolerant cells originating from the transferred bone marrow. Thymectomy was therefore used as a method of preventing the transferred bone marrow from replacing the transferred tolerant population of lymphatic cells. The results with thymectomized hosts showed, that those mice that received only chimera bone marrow had a general nonreactivity to allogeneic tissue antigens, whereas the mice which received bone marrow and lymphatic cells from the tolerant chimeras showed a lasting and specific nonreactivity (tolerance) to the antigens of the first host. Thymocytes were only effective in maintaining the tolerant state when they were transplanted into thymectomized hosts. (auth)

## Ecology

*Refer also to abstract 45216.*

**42731** (RLO-1751-2) ELEMENT AND ENERGY TRANSFER IN LOWER TROPHIC LEVELS IN THE MARINE ENVIRONMENT. Progress Report, April 1, 1963-March 31, 1966. Small, Lawrence F.; Hebard, James F.; Cross, Ford A.; Bergeron, Daniel J.; Fowler, Scott W. (Oregon State Univ., Corvallis. Dept. of Oceanography). June 1, 1966. Contract AT(45-1)-1751. 130p. Dep. mn. CFSTI $4.00 cy, $1.00 mn.

Results are summarized from ecological studies of the Northeast Pacific Ocean in which $^{65}$Zn was used for rapid and precise estimates of assimilation rates of biologically important second-trophic level grazers in the sea. Emphasis was placed on studies of the euphausiids, since these trophic level crustaceans occupy such an important place in the world ocean and since the species migrate vertically through a wide temperature range in Oregon waters. Data are included on the distribution and abundance of second trophic level grazers in space and time in the area studied; the effect of short-term temperature changes on the accumulation of $^{65}$Zn from the water and food chain by copepod species, and the subsequent return of $^{65}$Zn to the water of the radiozone; the effects of large (pollution level) concentrations of $^{65}$Zn on the uptake, retention, and loss of $^{65}$Zn by second trophic level organisms under varying environmental conditions, including seasonal surface current changes off the Oregon coast that affect temperature and salinity of the water and other hydrographic conditions. Artemia nauphlii and phytoplankton algae were used to measure ingestion by the euphausiids. (C.H.)

**42732** INFLUENCES OF A THERMONUCLEAR CRATERING TEST ON CLOSE-IN POPULATIONS OF LIZARDS. Turner, Frederick B.; Gist, Clayton, S. (Univ. of California, Los Angeles). Ecology, 46: 845-52(Autumn 1965).

On July 6, 1962, a large thermonuclear device was detonated at the Nevada Test Site (Project Sedan). It was buried 635 ft underground and had a total yield of 10 kt. The explosion ejected about 7.5 million yd$^3$ of alluvium and produced a crater 320 ft deep and 1200 ft in diameter. As a part of an investigation of the ecological influences of underground detonations, a study was made of lizard populations within 10,000 ft of ground zero. Adult Cnemidophorus tigris, Crotaphytus wislizeni, and Uta stansburiana were exterminated within 4000 ft from ground zero. Very few adult lizards of any species were observed within 6000 ft. No changes attributable to the test were detected at 8500 to 9000 ft. Eggs of the three species hatched following the test in areas where adults did not survive. Young Uta stansburiana were numerous in August from 2600 to 9000 ft from ground zero. By October, the young lizards at 2600 ft were gone, and mortality at 3800 ft was extremely heavy. At 9000 ft the apparent density of young Uta was only slightly reduced as compared to that in August. In June, 1963, adults of the three species were observed between 4500 and 5000 ft from ground zero, and Uta was apparently most abundant. It is possible that Cnemidophorus was more sensitive than Uta to the deleterious influences. The immediate mortality within 4000 ft is attributed to the gross physical effects of the detonation (dirt fall and blast) which destroyed all of the vegetation out to 2000 ft and caused partial damage to 5000 ft. Delayed mortality, as that exhibited by juveniles which hatched after the test, is attributed to destruction of habitat. Neither the depletion of food resources nor the residual radiation is likely to have been lethal. Absorbed tissue doses, as registered by three microdosimeters implanted in lizards before the test and recovered July 28, were probably significantly less than the free-air dose registered in the same area. (BBB)

**42733** SOIL AND SEDIMENT ANALYSIS: PREPARATION OF SAMPLES FOR ENVIRONMENTAL RADIATION SURVEILLANCE. Abrahams, John H. Jr.; Johnson, Raymond H. Jr. Environmental Health Series. Public Health Service Publication No. 999-RH-19. Washington, D. C., Public Health Service, 1966. 32p.

Soil samples were separated into size fractions to determine those in which uptake was greatest following the addition of different concentrations of zinc 65 tracer in aqueous suspensions, and to evaluate several methods of fractionation. Activity per gram for particles less than 43 microns was 7 to 8 times greater than for 43 to 250 microns particles. This factor increased as the particle sizes decreased. Activity on each size fraction increased with increasing concentrations of the zinc 65 tracer in aqueous suspensions, as well as with increasing organic content. Wet sieving with mild physical dispersion was a more convenient and reproducible method of separating the fine and coarse fractions than sedimentation and elutriation. Ultrasonic vibrations and high-speed stirring were evaluated as means for achieving the dispersion necessary prior to screening for radioanalysis of sediment fractions. A microscopic analysis of sediments before and after dispersion indicated that ultrasonic treatment released silt particles bound together by organic matter. The degree of dispersion was found to be generally dependent on sonification time but samples of about 35 grams were adequately dispersed after 15 to 20 minutes of treatment. In contrast, high-speed stirring caused little dispersion during the same time interval. Ultrasonic dispersion and screening of sediments dosed with the gamma emitter zinc 65 indicated that 54 percent of the activity was associated with particles smaller than 43 microns. A corresponding fraction after stirring contained only 32 percent of the activity. This demonstrates the large errors possible owing to poor dispersion by stirring. These studies demonstrate that bulk samples composed largely of coarse material generally are poor indicators of radionuclide concentrations. By counting that fraction of the field samples, which contains the predominant amount of activity, and by standardizing laboratory procedures the usefulness and sensitivity of these samples for surveillance would be greatly enhanced. (auth)

**42734** STUDY OF AN ECOSYSTEM IN THE COASTAL WATERS OF THE LIGURIAN SEA. II. SURFACE ZOOPLANKTON. Gilat, Eliezer; Kane, Jasmine E.; Martin, Jean-Claude (IAEA, Monaco). Radioact. Sea, No. 19, 1-56(1966).

Surface zooplankton in the coastal waters of Monaco were examined both quantitatively and qualitatively. The qualitative examination indicated that during most months of the year the copepods formed between 75 and 90 percent of the total zooplankton taken; groups frequently occurring included Appendicularia, Cladocera and Chaetognatha; those less frequent included Pteropoda, Thaliacea and Siphonophora. Among the copepods, species belonging to five genera in particular were the most consistently abundant and a special investigation of these species was made including counts, and comparisons of their distributions as reported by other workers in the western Mediterranean. Seasonal variations of the zooplankton biomass became evident from the volumetric data; the spring peak of abundance occurred from March to May in both 1963 and 1964, and a less pronounced peak occurred during the summer months of July and August, 1963. A comparison has been made between our data regarding the volumes of plankton taken and comparable data recorded from three other regions: Delaware Bay and Long Island Sound in the North Atlantic and the Zanzibar Channel in the Indian Ocean. (W.E.B.)

**42735** CONTAMINATION OF POULTRY MEAT AND EGG PRODUCTS WITH $^{137}$Cs. Schroeder, K.; Kreuzer, W. (Univ., Munich). Zentralbl. Veterinaermed., Ser. B, 12: 617-21(1965). (In German).

A study was made in poultry of the influence of management and feeding on the $^{137}$Cs contamination of meat and eggs (albumen and yolk). Birds given the opportunity to pick up earth and grass showed higher radioactivity in their flesh than birds in the same conditions but receiving ordinary commercial mixed food. The $^{137}$Cs activity in egg albumen and yolk was far less than in the meat. The potassium content of the meat showed similar changes. Of the radionuclides demonstrable by gamma spectrometry in the food ($^{95}$Zr/$^{95}$Nb, $^{103}$Rh, $^{144}$Ce, and $^{137}$Cs) only $^{137}$Cs could be demonstrated spectrometrically in the flesh. (auth)

**42736** INCREASING $^{137}$Cs LEVEL IN LAPPS AND OTHER PEOPLE IN NORTHERN SWEDEN. Liden, Kurt (Univ. of Lund, Sweden). 5p. (CONF-747-8). ORAU.

From 4th Symposium on Radioactivity in Scandinavia, Riso, Denmark, Oct. 1964.

Analyses were made on the cesium-137 content of the human body and reindeer meat in different localities in Northern Sweden between 1961 and 1964. Whole-body counting was performed on randomly selected subjects. There was a close correlation between levels of cesium-137 in people and in reindeer meat, and there was a steady increase in levels from 1961 to 1964. Lower concentrations were found in the northernmost districts and higher concentrations were found in the southernmost districts. The meat level can be predicted approximately from an analysis of the cesium-137 content of winter fodder plants, particularly lichens, performed immediately before the snow starts to cover the ground. (H.L.W.)

## Metabolism, Tissue Distribution, and Toxicology

*Refer also to abstract 43000.*

**42737** (ANL-7136, pp 231-42) ENZYMOLOGY. (Argonne National Lab., Ill.).

Progress is reported on studies on enzyme reactions involved in the synthesis of methionine in Saccharomyces cerevisiae, Escherichia coli, and jack bean meal; the synthesis of propionate by Propionibacterium shermanii; metabolism of the four-carbon polyalcohol, erythritol, by Propionibacterium pentosaceum; the metabolism of liver mitochondrial proteins; and sterol metabolism in rat liver homogenates in which $^{3}$H-labeled synthetic 14a-methyl sterols and synthetic cholestanol-1-$^{14}$C-acetate were used as tracers. (C.H.)

**42738** (ANL-7136, pp 255-65) ISOTOPE STUDIES: TECHNIQUES AND APPLICATIONS. (Argonne National Lab., Ill.).

Progress reported on studies on the effects of trace amounts of isotopes on biological systems. Data are included on the effects of $D_2O$ on pancreatic lipase; the effects of $D_2O$ on beef heart aconitase; and the metabolism of $^{3}$H-thymidine in mice. Techniques are described for the exchange labeling of chromatographic systems and for isotopic fractionation during analytical separations. Standards are presented for the evaluation of scintillation counters. (C.H.)

**42739** (COO-1339-3) A STUDY OF FISSION PRODUCT LEVELS AND METABOLISM IN FOOD PRODUCING ANIMALS AS DETERMINED BY WHOLE BODY COUNTING. Progress Report, August 15, 1965–August 15, 1966. (Illinois Univ., Urbana). Contract AT(11-1)-1339. 37p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The Illinois Animal Science Counter (ILLASCO) was calibrated for $^{40}K$ gamma detection efficiency in human beings by means of intravenous $^{42}K$ injection of 25 male volunteers. The calibration will be used in studies of the effects of exercise on body composition by the Department of Physical Education, University of Illinois. Calibrations for $^{40}K$ detection efficiency in swine were continued, also by the use of $^{42}K$ administration. Potassium-40 measurements are being studied in relation to growth and as a means of selecting breeding stock in both sheep and swine. Several hundred animals are being used in the projects. Cesium-137 retention was measured in 3 cattle and 2 calves for 60 days after both oral and intravenous dosing, and in 4 sheep for 60 days after intravenous dosing. Retentions in both species can be described as 3-component sums of exponentials. For cattle after oral dosing, excretory processes having half-lives ($T_{1/2}$) of 1.3, 4.6, and 32 days accounted for 0.21, 0.33, and 0.43 of the administered dose, respectively. For 1 pregnant cow, compartment 3 had a $T_{1/2}$ of 42 days and accounted for 0.58 of the dose. Calves excreted $^{137}Cs$ more rapidly than cows, primarily because greater fractions of the dose were lost via the fast compartments 1 and 2. In cows, intravenous dosing appeared to accentuate loss by the first component at the expense of the second. In sheep, the average $T_{1/2}$'s were 1.2, 5.0, and 27 days, accounting for 0.28, 0.33, and 0.39 of the dose, respectively. Methods for studying $^{47}Ca$ kinetics in dairy goats were developed. From November 15, 1965, to August 15, 1966, fifteen injections of $^{47}Ca$ were made in each of 5 animals. Blood specific activity-time curves and whole-body retentions were obtained and exchangeable Ca pool sizes (E) and pool half-lives were calculated. Before pregnancy and during early pregnancy, E remained rather constant in individual animals and ranged between 3 gm Ca and 14 gm Ca in 5 goats. Pool half-lives varied from 20 hours to 32 hours. During late pregnancy, pool half-lives decreased as parturition approached to as low as 11 hours. An investigation of $^{85}Sr$ retention in pigs was initiated. The effects of age at which $^{85}Sr$ is administered and of dietary Ca and P content on retention are being studied. (auth)

**42740** (LA-DC-7764) MOVEMENT OF DISCRETE PARTICLES IN THE 100- TO 200-MICRON DIAMETER RANGE THROUGH THE GASTROINTESTINAL TRACT OF LABORATORY ANIMALS AND MAN. Richmond, C. R.; Furchner, J. E. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1961]. Contract W-7405-eng-36. 35p. (CONF-660917-4). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Gastrointestinal Radiation Injury Symposium, Richland, Wash.

The possibility of atmospheric reentry and burnup of nuclear rocket propulsion reactors and auxiliary power supplies and attendant biological problems were studied. Consideration of radiation dose from an insoluble discrete radioactive particle temporarily residing in the lumen of the gut requires a knowledge of the time-course of retention by specific segments of the gastrointestinal tract. Unfortunately, lack of agreement on the average time required for any material to pass through the gastrointestinal tract is augmented by the great variability in dietary and defecation habits among people. This specific problem is complicated by the density of the particles involved (10 to 19 grams per cubic centimeter). Gamma-ray spectrometry was used to identify electromagnetic radiations from ceramic spheres containing $^{54}Mn$ and from uranium carbide fuel cores. The $^{235}UC_2$ particles were about 170 microns in diameter with a density of 10.8; the ceramic spheres were about 150 microns in diameter with a density of 3.0. Information obtained from 156 individual particles given to 57 subjects yielded an average gross transit time (GTT) of 34.5 hours (range 14 to 72). The GTT values were not normally distributed. No effect of density on transit time was observed. On the average, particles were passed in the second stool sample. Time of ingestion was found to affect transit time in a given individual. Chronic feeding of labeled particles to experimental animals showed a relatively rapid movement through the stomach and small intestine, followed by a hold-up in the cecum and temporary storage in the large intestine. For the dog, particles remained in the cecum and large intestine for 50 to 70 percent of the total transit time. This work suggests that small high-density $UC_2$ fuel cores (nonfissioned) are not preferentially retained by the gastrointestinal tract. The effect of radioactivity on GTT was not investigated. (auth)

**42741** (NP-16265) K VOPROSU O SODERZHANII TSEZIYA-137 V KOSTNOI TKANI CHELOVEKA. ($^{137}Cs$ Content in Human Bone). Golutvina, M. M.; Yartsev, E. I.; Kazakova, T. A. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). 1965. 10p. Dep. mn.

A new method for determining cesium-137 in human bones utilizing ash weights of 60–80 g per analysis is presented. The method was applied to bone from 99 Moscow residents who died in 1961, 1963, and 1964. Most of the material was of femoral origin. While the cesium-137 concentration in adult bone during 1963–1964 was of the order of 0.12 pc/g ash, in children the corresponding concentration was higher by a factor of 2–4. The $^{90}Sr$ to $^{137}Cs$ ratio in adult bones was within the limits of 3–4. (P.C.H.)

**42742** (STI-PUB-113) ISOTOPES IN WEED RESEARCH. Proceedings Series. Proceedings of the Symposium Jointly Organized by the International Atomic Energy Agency and the Food and Agriculture Organization of the United Nations and held in Vienna, 25–29 October 1965. (International Atomic Energy Agency, Vienna (Austria)). May 1966. 246p. (CONF-651076-1). IAEA: $5.00; S105,-; £ 1.10.0; F Fr 20,-; DM 17,50.

Seventeen papers discuss recent developments in the use of radioisotopes as tracers in weed research, and particularly for studying the comparative absorption of herbicides by different plant species, the distribution of herbicide within the plant; herbicide residues in plants and soil, the detoxification of herbicides, and the identification of degradation products and for determining the ultimate fate of herbicides. (C.H.)

**42743** (UCRL-14631) ION BINDING PROPERTIES OF HUMAN SERUM LIPOPROTEINS. Robison, William Lewis (Lawrence Radiation Lab., Univ. of California, Livermore). Jan. 6, 1966. Contract W-7405-eng-48. 68p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Thesis.

Certain anion and cation binding properties of the serum lipoproteins $HDL_3$ and LDL ($S_f$ 3-9) were studied. The protein moiety of the $HDL_3$ was also studied for comparative purposes. The binding studies were accomplished by using the equilibrium dialysis technique. Both the HDL and LDL showed a considerable capacity for binding the selected anion methyl orange. The binding per mole exceeded that of serum albumin, which had previously been thought to be the only serum protein with such a capacity. Even among nonserum proteins which were studied this was an uncommon property. The LDL had a greater binding capacity than the $HDL_3$ when considered on a molar basis, when considered in terms of total protein, and when considered in terms of total protein plus phospholipide available. The LDL showed a multiple-site type of binding curve now observable with the $HDL_3$ over the concentration range studied. The protein moiety of the HDL did bind the anion methyl orange but at a much reduced strength and capacity. This was interpreted to indicate additional stability imparted to the binding process by the lipides through nonpolar forces. The serum lipoproteins representing certain types of lipoprotein complex showed a very low capacity for binding the cations Ca and Mg. The association constants are of the order of $10^3$ or about the same as other protein systems such as albumin. This is much below that reported for some membranes which are lipide-protein in character, and possible reasons for the differences are discussed. (117 references.) (C.H.)

**42744** (UCRL-16246, pp 19-35) WHOLE-BODY COUNTING OF $^{47}$Ca AND $^{85}$Sr. Sargent, Thornton; Linfoot, John A.; Isaac, Elsa L. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

Studies of bone metabolism with whole-body counters and compartment models of skeletal metabolism are evaluated. Clinical data are reported and analyzed on $^{47}$Ca and $^{85}$Sr metabolism in patients who received pituitary irradiation with the 900 Mev alpha beam of the 184 in. cyclotron at Berkeley. When $^{85}$Sr was injected in addition to $^{47}$Ca, the $^{85}$Sr was injected first and the patient was counted immediately; and then the $^{47}$Ca was injected and the patient counted again. Most studies began at the time of irradiation. The fundamental assumption used in the work was that the final $^{85}$Sr slope is the same as that of Ca, and that this slope can be applied to the $^{47}$Ca retention curve to obtain a complete equivalent whole-body-retention curve for $^{47}$Ca for up to one year. Results indicated that both $^{47}$Ca and $^{85}$Sr should be used if one is to obtain a complete picture of Ca turnover in a patient by whole-body counting. It is equally clear that whole-body counting alone is not enough; long-term blood studies with $^{45}$Ca are required and measurement of other compartments is prefered, before a comprehensive and accurate mathematical model for Ca metabolism can be developed and tested. (H.G.D.)

**42745** (UCRL-16246, pp 126-37) EFFECTS OF SIMULATED ALTITUDE ON IODINE METABOLISM. I. ACUTE EFFECTS ON SERUM AND THYROID TURNOVER. LaRoche, Gilles; Johnson, Clarence L. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

Experiments are reported that show that simulation altitude induces a significant change in iodine turnover in rats, as observed in combined $^{125}$I and $^{127}$I studies. Body weights of animals placed in altitude chambers were depressed after two days, an effect that persisted for the entire exposure time of 15 days. Total thyroid $^{127}$I content and glandular $^{125}$I uptake were significantly higher on the 3rd and 8th days of exposure, glandular uptake of $^{125}$I being increased, in addition, on the 2nd day. Serum $^{127}$I concentrations were lower, often drastically so, on all days except the 15th, whereas total $^{125}$I serum values did not appear significantly different from control values. Estimates of thyroid secretion rates were 2.2% of the injected dose of $^{125}$I for controls and 0.5% for treated rats. Similarly, the thyroidal-iodine-turnover was 23 and 100 days for controls and treated respectively. (H.G.D.)

**42746** (UR-49-687, pp 66-116) TOXICITY OF RADIOELEMENTS. (Rochester Univ., N. Y. Atomic Energy Project).

Abstracts are presented on 36 publications for 1965 on the toxicity of radioelements. Bibliographic information is included. (C.H.)

**42747** (UR-49-687, pp 148-76) CHEMICAL TOXICITY. (Rochester Univ., N. Y. Atomic Energy Project).

Abstracts are presented on 28 publications during 1965 on chemical toxicity and hematology. Bibliographic information is included. (C.H.)

**42748** KINETICS OF DISTRIBUTION OF $D_2O$ IN CANINE INTESTINAL TISSUES. Weiner, Daniel E.; Grim, Eugene (Univ. of Minnesota, Minneapolis). Amer. J. Physiol., 211: 600-6(Sept. 1966).

The uptake of DHO by the mucosa, submucosa, muscle, and mesentery of isolated canine intestinal segments during artificial perfusion with arterial blood having a constant DHO concentration has been studied. When the data are subjected to compartmental analysis, all four tissues appear to contain three water compartments with the turnover constant of the slowest being in each instance only 1-2% min. A plausible anatomical arrangement which seems most consistent with ancillary information is that one of the three compartments is identical with the extracellular space, with the other two being intracellular. The slower of the latter two may be identified with the nucleus and mitochondria. (auth)

**42749** AMOUNT AND DISTRIBUTION OF $^{86}$Rb TRANSPORTED INTO MYOCARDIUM FROM VENTRICULAR LUMEN. Myers, Wayne W.; Honig, Carl R. (Univ. of Rochester, N. Y.). Amer. J. Physiol., 211: 739-45(Sept. 1966).

The left coronary arteries of dogs were perfused with unlabeled blood while $^{86}$Rb- and $^{51}$Cr-tagged erythrocytes were administered systemically. Perfusion rate was continuously adjusted to maintain mean coronary and aortic pressures equal. The extravascular $^{86}$Rb content of the entire left ventricle would have been provided by 4% of mean coronary blood flow, indicating that transport from the lumen is not important for the over-all nutrition of the unstressed heart. Luminal blood is, however, a major source of supply for the deep spiral and papillary muscles; the average $^{86}$Rb content of the inner-most 2 mm was equivalent to a coronary blood flow of 25 ml/100 g per min. Significant amounts of extravascular $^{86}$Rb were detected as much as 10 mm from the lumen. Evidence is offered for the view that both diffusion from endocardial surfaces and transport by luminal vessels contributed to $^{86}$Rb uptake. The functional significance of a luminal blood supply to the innermost fibers is discussed in relation to transmural gradients of coronary blood flow and tissue oxygen tension. (auth)

**42750** ABSORPTION AND EXCRETION OF CALCIUM BY TELEOST FISHES WITH SPECIAL REFERENCE TO ROUTES FOLLOWED. **Mashiko, Kikyua; Jozuka, Kenji (Univ. of Kanazawa, Japan). Annot. Zool. Jap., 37: 41-50 (Mar. 1964).**

Paths of the uptake and the extrarenal excretion of $^{45}$Ca were studied in the crucian carp Carassius carassius and a marine teleost, Duymaeria flagellifera. The experiments were carried out by enveloping the posterior body or the caudal fin with a rubber sac so that parts of the body of the fish could be exposed to different media containing $^{45}$Ca. The body surface of the fish is considered to be practically impermeable to $^{45}$Ca except for limited sites. When the anterior and the posterior parts of the body were separately exposed to medium containing $^{45}CaCl_2$, $^{45}$Ca uptake was shown to take place in both cases. In the crucian carp, $^{45}$Ca uptake through the anterior body is apparently large as compared with that through the posterior body. In D. flagellifera, on the contrary, $^{45}$Ca uptake through the posterior body is more marked than that through the anterior body including the gills and mouth. When only the caudal fin was exposed to the isotope, $^{45}$Ca was accumulated by various osseous tissues, scales, gills, and fins. Thus, besides the gills, fins seemed to be also important as the path of $^{45}$Ca uptake, and, especially in marine fishes, fins may play a more significant role than the gills and mouth. In a similar way, the efflux of $^{45}$Ca across the caudal fin was also demonstrated. When $^{45}CaCl_2$ was injected into the dorsal muscle of the crucian carp, the isotope was found in the inner medium of the sac enveloping the caudal fin. The $^{45}$Ca was excreted also through the intestinal epithelium not only when the isotope was injected into the dorsal muscle, but also when it was previously taken up from the aqueous environment. This may indicate that Ca is continously excreted through the intestinal epithelium in the natural condition. (BBB)

**42751** HISTORY OF BERYLLIUM DISEASE. Shipman, Thomas L.; Vorwald, Arthur J. pp 9-17 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.

The first significant evidence concerning occupational beryllium poisoning was reported in 1933. The increased production of beryllium oxide for use in fluorescent lamps and neon signs resulted in the development of beryllium poisoning in a number of employees of these industries, and evidence regarding cause-and-effect relationships was compiled. In 1947 a central registry was established for the accumulation of data for the comparative analysis of data concerning beryllium exposure and clinical symptoms. Problems involved in the diagnosis of beryllium disease are discussed. (34 references.) (C.H.)

**42752** EXPOSURES AND PATTERNS OF DISEASE IN THE BERYLLIUM INDUSTRY. **Breslin, A. J. pp 19-43 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.**

Beryllium exposure causes disease in several forms, which are roughly classed as skin diseases and respiratory diseases. The patterns of exposure in the beryllium industry are described and are related to the clinical picture. Skin effects consist of contact dermatitis, ulcers, and subcutaneous granulomata. Two types of acute pneumonitis have been reported, fulminating and insidious. The symptoms of beryllium poisoning are described. The history of the diagnosis of beryllium disease is reviewed and health hazards in modern beryllium facilities are discussed. (46 references.) (C.H.)

**42753** MEDICAL ASPECTS OF BERYLLIUM DISEASE. **Vorwald, Arthur J. pp 167-200 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.**

Beryllium and its compounds have wide industrial applications. The history and pathology of beryllium disease, including beryllium pneumonitis and chronic beryllium poisoning, are reviewed. Clinical manifestations and diagnostic methods are discussed. (69 references.) (C.H.)

**42754** EXPERIMENTAL BERYLLIUM TOXICOLOGY. **Vorwald, Arthur J.; Reeves, Andrew L.; Urban, Edward C. J. pp 201-34 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.**

Results are reviewed from numerous studies of Be toxicology in experimental animals, including monkeys, rabbits, rats, guinea pigs, and others. The toxic manifestations of Be are described. These included bone sarcoma in rabbits; pulmonary cancer in monkeys and rats; acute pneumonitis; chronic pneumonitis; rickets; osterosclerosis; and other symptoms. Extensive pharmacological studies of many chemical agents showed that salicylic, sulfosalicylic, and gentisic acids were somewhat active when used as therapeutic agents in beryllium disease and aurintricarboxylic acid (ATA) was dramatically effective. Results are included from studies of the biochemical effects of Be in animals and the mechanism of carcinogenesis. (115 references.) (C.H.)

**42755** RECOMMENDED HYGIENIC LIMITS OF EXPOSURE TO BERYLLIUM. **Stokinger, Herbert E. pp 235-44 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.**

Recommended hygienic limits for Be in air, drinking water, and streams are reviewed. Recommendations adopted by the Atomic Energy Commission, the American Conference of Government Industrial Hygienists, and U. S. Public Health Service are discussed. The effectiveness of industrial hygiene practices in reducing the exposure of employees in industrial establishments using Be is also discussed. (14 references.) (C.H.)

**42756** MEDICAL MANAGEMENT OF BERYLLIUM WORKERS. **Van Ordstrand, Howard S.; Zielinski, John F.; DeNardi, Joseph M. pp 323-7 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.**

Medical practices at beryllium plants are outlined. It is pointed out that the potential frequency of acute dermal problems and the need to constantly evaluate acute respiratory complaints will keep a physician busy at a Be extraction plant. Where work is done in a physical manner on the pure metal or oxide acute problems are rare. The value of the pre-employment physical is discussed and criteria for the rejection of prospective employees are outlined. (C.H.)

**42757** THERMAL STABILITIES AND SPECIES SPECIFICITIES OF REANNEALED ANIMAL DEOXYRIBONUCLEIC ACIDS. **Martin, Malcolm A.; Hoyer, Bill H. (National Institutes of Health, Bethesda, Md.). Biochemistry, 5: 2706-13(Aug. 1966).**

Single-stranded mouse deoxyribonucleic acid (DNA) fragments incubated at 55, 60, or 65° in double-strength standard saline-citrate solution partially lose their capacity to react subsequently with mouse DNA single strands embedded in agar. The extent of this loss is time and concentration dependent. Incubated fragments fully regain their original capacity to bind to DNA-agar when heated to 100° and rapidly cooled. The proportion of mouse DNA fragments binding to mouse DNA-agar at 40° (81%) is considerably greater than the fraction reacting at 67° (21%). A large proportion (66%) of chicken DNA fragments, for example, also bind to mouse DNA-agar at 40° while at 67° only 0.9% reacts. When a mixture of $^3$H-labeled mouse DNA fragments and $^{32}$P-labeled rhesus monkey DNA fragments are incubated with mouse DNA-agar, the ratio of $^3$H/$^{32}$P bound is 7 at 40° and 35 at 67°. When the same labeled pair is similarly examined with rhesus monkey DNA-agar the $^3$H/$^{32}$P bound falls from about 6 at 40° to 1 at 67°. Therefore, the ability to discriminate among animal DNA's with the DNA-agar technique increases as a function of the incubation temperature. (auth)

**42758** SIMULTANEOUS MEASUREMENTS OF $^{24}$Na$^+$-EFFLUX AND PYRIDINE NUCLEOTIDES IN SLICES OF RAT LIVER. **Van Rossum, G. D. V. (Univ. of Pennsylvania, Philadelphia). Biochim. Biophys. Acta, 122: 312-22(Aug. 10, 1966).**

The efflux of $^{24}$Na$^+$ from rat-liver slices incubated at 30° showed two main components, the slower of which appeared to be largely representative of the intracellular Na$^+$. Some two-thirds of the efflux of intracellular $^{24}$Na$^+$ was due to a passive exchange for $^{23}$Na$^+$ in the medium. The remaining one-third was associated with net transport of Na$^+$ and K$^+$ by the liver cells; it was inhibited by anaerobiosis, KCN and ouabain, and partially inhibited by oligomycin. Fluorescence measurements of pyridine nucleotides in the slices could satisfactorily be made simultaneously with the efflux measurements, inhibition of efflux by anaerobiosis or KCN being usually somewhat preceded by pyridine nucleotide reduction. Oligomycin induced only slight reduction of the pyridine nucleotides. These findings are all consistent with earlier work on the dependence of ion transport in rat-liver slices on oxidative phosphorylation. However, treatment with succinate caused some inhibition of ion movements. (auth)

**42759** EFFECTS OF POTASSIUM, OUABAIN, AND VALINOMYCIN ON THE EFFLUX OF $^{24}$Na$^+$ AND PYRIDINE NUCLEOTIDES OF RAT-LIVER SLICES. **Van Rossum, G. D. V. (Univ. of Pennsylvania, Philadelphia). Biochim. Biophys. Acta, 122: 323-32(Aug. 10, 1966).**

The efflux of $^{24}$Na$^+$ from rat-liver slices incubated in a K$^+$-free medium was stimulated by 40% when 6.4 mM K$^+$ was added to the medium. The K$^+$-dependent portion of the efflux was completely inhibited by ouabain; ouabain also slightly inhibited the efflux of $^{24}$Na$^+$ into K$^+$-free medium. In one-third of the experiments, treatment with K$^+$ caused an oxidation of pyridine nucleotides which was reversed by subsequent removal of K$^+$ or treatment with ouabain; this was consistent with the transition of the slice mitochondria towards a more active metabolic state upon stimulation of ion transport. In the remaining experiments, K$^+$ induced a reduction of pyridine nucleotides which was little affected by removal of K$^+$ or ouabain treatment; comparison with the effect of Amytal suggests that the pyridine nucleotide so reduced was exclusively NAD$^+$ of the respiratory chain. The reduction process appears to be largely independent of the effect of K$^+$ on ion transport. Valinomycin tended to inhibit $^{24}$Na$^+$ efflux slightly in the presence of K$^+$. It caused a small reduction of the pyridine nucleotides. (auth)

**42760** THE MODIFICATION OF DURATION OF PHYSIOLOGIC ACTIVITY OF INSULIN SUBJECTED TO

LABELING WITH $^{131}$I OR TO THE RADIOACTIVITY OF THE SAME ELEMENT. **Pellegrini, G.; Maggi, G.; Rodari, T.; Specchia, G.; Tirella, G.; Fratino, P.; Foschi, G. C. (Univ., Pavia). Boll. Soc. Ital. Biol. Sper., 41: 1332-5(Dec. 31, 1965). (In Italian).**

The autoradioinactivation of insulin in solution was studied to evaluate the loss of physiologic activity of the hormone, which is being used now in labeled for in many experimental and clinical tests. The porcine insulin used had been iodinated with $^{131}$I to give a specific activity of crystalline material of 2 mC/mg. Solutions were prepared in water acidified with HCl (to pH 3.5) and were tested at 24, 48, 72, and 96 hr after incubation at 4°C. Comparative tests were conducted on solutions of unlabeled insulin to which an equivalent amount of $^{131}$I (2 mC/mg) was added. Five types of biologic assay were conducted. With measurement of hypoglycemia in rabbits, both preparations of insulin lost activity rapidly and in parallel during the first 48 hr; 100% of the activity was lost by 72 hr. Parallel loss of activity was also seen in mouse convulsion tests (15 to 20% loss at 72 hr), the rat diaphragm test (67% loss at 72 hr), and the rat epididymal fat test (70% loss at 72 hr). The results demonstrate the rapid radiolysis of insulin by $^{131}$I under the conditions studied. (BBB)

**42761** MODIFICATION OF THE BIOLOGIC ACTIVITY OF LABELED INSULIN IN RELATION TO THE DEGREE OF IODINATION, SPECIFIC ACTIVITY, AND METHOD OF LABELING. **Pellegrini, G.; Rodari, T.; Maggi, G.; Specchia, G.; Tirella, G.; Fratino, P.; Foschi, G. C. (Univ., Pavia). Boll. Soc. Ital. Biol. Sper., 41: 1338-41 (Dec. 31, 1965). (In Italian).**

Three biologic assay methods were used to evaluate the influence of various parameters on the radioinactivation of insulin: the rabbit hypoglycemia test, convulsant activity in mice, and immunologic activity. In the first experiment to test the influence of degree of radioiodination, three samples of porcine insulin, radioiodinated by an electrolytic method, were tested. These had a specific activity of 0.04, 1.04, and 3.88 mC/mg 4 hr after labeling. It was found that the latter sample (3.88 mC/mg) had lost 50% of its hypoglycemic activity in rabbits, but the other samples showed no loss of such activity. The other two tests showed no loss of activity. When samples of 2.4, 5.5, and 10 mC/mg specific activity were tested at the end of 36 hr, no loss of activity was seen by the immunologic test, but the 5.5- and 10-mC/mg samples lost 15 and 30% activity, respectively. In general, an electrolytic method of labeling resulted in a more stable product than a chemical method of labeling. (BBB)

**42762** UPTAKE AND RETENTION OF RADIOACTIVE STRONTIUM IN NORMAL SUBJECTS. Rundo, J.; Lillegraven, A. L. (Atomic Energy Research Establishment,

Measurements of radioactivity in five men were made during and after a period of chronic oral exposure ($\sim$0.5 $\mu$C/day) to $^{85}$Sr. The experimental methods used to determine whole-body contents and skeletal contents are described. The retention up to $\sim$500 days after the end of the exposure could be well described either by a three-component exponential function of time or by the integrated form of the sum of an exponential function and a power function of time, and the appropriate form of the latter predicted with fair accuracy the build-up of skeletal $^{85}$Sr during the exposure in the two cases where experimental data were available. The average retention equations were used to calculate the bone levels during 1953 to 1964 of of fall-out $^{90}$Sr in adults in the United Kingdom using the average dietary intake. The results suggested that the average biological half life of 750 days found in this study is too short for predictions over long periods. Use of a biological half life of 2,000 days gave results which were very similar to those from the integrated power function, but which were about half the observed bone levels in the national survey. A possible reason for this is discussed. (auth)

**42763** THE EFFECT OF CORONARY VASODILATATION (DIPYRIDAMOLE-INDUCED) ON THE MYOCARDIAL DISTRIBUTION OF TRITIATED WATER. Palmer, Wilfred H.; Fam, Wadie M.; McGregor, Maurice (McGill Univ., Montreal). Can. J. Physiol. Pharmacol., 44: 777-82(Sept. 1966).

The uptake of tritiated water in the left ventricle has been studied constantly increasing concentrations of tritium in two groups of normal dogs, one of which received dipyridamole intravenously while the other acted as control. Dipyridamole administration was associated with a 1.6 times greater coronary flow and an appropriate reduction in arterial coronary sinus oxygen difference. As judged by the concentrations of indicator in different myocardial samples the perfusion of the myocardium of the normal dog is relatively homogeneous. No differences were detected between the inner and outer half of the ventricular wall or between the apical region and the free wall of the left ventricle. Comparison of myocardial and coronary sinus concentrations of tritium indicated that the increased coronary flow following dipyridamole was the result of an increase in the effective capillary flow rather than a shunting through diffusion-limited pathways, such as would occur in functional or anatomical arterio-venous shunts. (auth)

**42764** PRELIMINARY STUDY OF HUMAN CALCIUM METABOLISM USING LONG-TERM WHOLE BODY TRACER MEASUREMENTS. Harrison, Joan E.; McNeill, K. G.; Finlay, J. M.; Sheppard, R. H.; Mortimer, D. C. Can. Med. Ass. J., 94: 1092-7(May 21, 1966).

Long-term bone calcium metabolism was measured using a whole body counter apparatus and the radioisotopes $^{47}$Ca and $^{85}$Sr. Strontium was given with calcium in a single intravenous injection in order to estimate long-term retention of calcium. Calcium-47, with a short radioactive half-life, was measured directly for 20 days, and then indirectly from strontium retention for periods up to 200 days. The standard parameters of calcium transport were measured and, as well, a new parameter, calcium accretion to the fixed bone pool. These studies were carried out on 13 subjects, six of whom were selected normals and seven were patients with osteoporosis. Calcium accretion to the fixed bone pool, the new index of bone formation, varied from 100 to 210 mg. of calcium daily in normal subjects and from 70 to 340 mg./day in patients with osteoporosis. These values are one-third of those for the accretion to the total bone pool, the previously reported bone formation rate. (auth)

**42765** EVOLUTION OF THE INCORPORATION OF RADIOSULFATE BETWEEN THE 13TH AND 18TH DAY OF DEVELOPMENT, IN THE EMBRYOS OF NORMAL OR IRRADIATED MICE. Novel, Madeleine (Institut National des Sciences Appliquees, Lyon). Compt. Rend., Ser. D, 262: 2760-3(June 27, 1966). (In French).

The existence of an allometric relation between the incorporation of radiosulfate and the evolution of weight during the development of the mouse embryo was shown. This allometry is maximum between the 13th and 18th day, indicating that the metabolism of the radiosulfate is intensified during this period. The irradiation at the 10th day does not modify the phenomenon. (tr-auth)

**42766** UPTAKE AND DISTRIBUTION OF CALCIUM AND OF MICROQUANTITIES STRONTIUM IN PLANTS. Seletkova, N. I. Dokl., Moskov. Sel'skokhoz. Akad., No. 79, 281-7(1962). (In Russian).

The discrimination between $^{90}$Sr and Ca uptake by oat grains was compared with that of wheat, barley, and peas. The ratio, $^{90}$Sr/Ca in the solution to $^{90}$Sr/Ca in the nutrient solution, showed changes as a function of the concentration of Ca in the nutrient media; this ratio is higher at average concentrations of Ca than in solutions with surplus Ca. The ratio found, $^{90}$Sr/Ca in the plant stems to $^{90}$Sr/Ca in the nutrient solution, in tests with barley and oats in the final growth stages of the plant exceeds unity for average levels of concentrations of Ca in the nutrient mixture. This ratio was less than unity when the plants were harvested at the end of the vegetation period. The deficiency of K in the nutrient solution somewhat decreases the ratio; $^{90}$Sr/Ca in the plant to $^{90}$Sr/Ca in the nutrient solution. A magnesium deficiency in the nutrient solution in test with oats and barley does not show significant effect on the size of the ratio. (tr-auth)

**42767** CLEARANCE OF URANIUM DIOXIDE DUST FROM THE LUNGS FOLLOWING SINGLE AND MULTIPLE INHALATION EXPOSURES. Morrow, P. E.; Gibb, F. R.; Leach, L. J. (Univ. of Rochester, N. Y.). Health Phys., 12: 1217-23(Sept. 1966).

A study of uranium-238 dioxide and uranium-235 dioxide aerosols in dogs revealed that the clearance of the lungs differs markedly after single and multiple inhalation exposures, namely approximately 180 and 340 days for the respective biological half-times. *In vivo* counting of the 186-kev gamma rays was the basic measurement employed for both aerosols. Additional data were obtained by excreta and tissue analyses. Some difficulties with *in vivo* counting of animals subjected to prolonged uranium exposures are discussed, as well as a description of several possible mechanisms whereby the clearance of the pulmonary region might be influenced by the type and frequency of aerosol exposure. (auth)

**42768** COMPARATIVE METABOLISM OF CESIUM AND POTASSIUM IN MAMMALS: INTERSPECIES CORRELATION BETWEEN BODY WEIGHT AND EQUILIBRIUM LEVEL. Fujita, M.; Iwamoto, J.; Kondo, M. (Japan Atomic Energy Research Inst., Tokyo). Health Phys., 12: 1237-47(Sept. 1966).

For the purpose of deriving, from laboratory animal data, the equilibrium level of radionuclides in humans, interspecies correlations between body weights and equilibrium levels of cesium and potassium after oral administrations were studied in mice, rats, rabbits and humans. The equilibrium levels, A, which were expressed in multiples of the daily intakes can be related to the body weights, W, of the mammals in grams as follows: $A = 0.85W^{0.45}$ for cesium and $A = 0.45\ W^{0.45}$ for potassium, except for the rabbits. In connection with the interpretation of the above formulae, the following four points were also investigated. (1) The ratios of the urinary excretion to the total excretion in the mammals are about 0.85 for cesium and potassium. (2) The renal clearances for cesium and potassium are nearly proportional to the $\frac{2}{3}$ power of the kidney weights, and the clearance values for potassium are about two times higher than for cesium. (3) The kidney weights are proportional to the 0.84 power of the total weights. (4) The ratios of the mean body concentration to the plasma concentration are nearly constant (= ~10) for cesium and potassium. Using these four facts, the formulae of the interspecies correlation were derived. (auth)

**42769** STRONTIUM RETENTION IN MICE TREATED WITH THYROID HORMONE. Simmons, David J.; Failla, Patricia (Argonne National Lab., Ill.). Health Phys., 12: 1249-57(Sept. 1966).

Bone studies have shown that thyroid hormones may reduce the whole-body retention (WBR) of bone-bound $^{85}$Sr in young growing CF$_1$ albino mice. Treatment with thyroxin (5, 10, 20 μg/day) and triiodothyronine (5, 10 μg/day) at all dose levels lowered the WBR of $^{85}$Sr 10–12 percent, and the effect was maximal after 3–4 weeks. The effects of tetraiodothyroacetic acid and triiodothyroacetic acid were dose dependent; 10-μg levels of each hormone were ineffective, but 30 μg lowered the WBR 5 percent after 4–5 weeks. While the process by which the thyroid hormones effect the reduction of bone-bound radiostrontium is not fully understood, possible mechanisms have been discussed. (auth)

**42770** ABSORPTION OF FISSION PRODUCTS BY MARINE ORGANISMS. Argiero, L.; Manfredini, S.; Palmas, G. (CAMEN, Pisa, Italy). Health Phys., 12: 1259-65 (Sept. 1966). (In French).

The sorption and the concentration factors of $^{90}$Sr and $^{137}$Cs in the mussel, *Mytilus galloprovincialis*, are studied. From the $^{90}$Sr data, it is shown that the equilibrium is maintained after 120 hr, and the concentration factor is 3.6 based on fresh weight (after centrifugation) and 98.3 based on ash weight. In the case of $^{137}$Cs the equilibrium is reached after about 100 hr, and the concentration factor, if based on fresh weight (at 110°C), varies from 4.3 for adult organisms to 6.4 for young organisms; whereas, if based on ash weight, it varies from 117 for adult organisms to 175 for young organisms. (tr-auth)

**42771** EFFECT OF GIBBERELLIC ACID ON THE PHOSPHATE AVAILABILITY IN VICIA FABA SEEDLINGS USING $^{32}$P. PART II. STUDIES ON INFLUENCE OF GIBBERELLIC ACID SPRAY ON THE ABSORPTION OF PHOSPHATE THROUGH ROOT AND SHOOT SYSTEMS. Hegazy, A. H. T.; Abdel Wahab, M. F. Isotopenpraxis, 2: 43-4(Jan. 1966).

Gibberellic acid, when sprayed on the tops of *Vicia faba* seedlings even in lower concentration, causes significant changes in the physiology of the plant. Simultaneous spray of gibberellic acid and Knop solution brings about an increase in the rate of $^{32}$P uptake. Gibberellic acid shows some inhibitory effects on the absorption and/or translocation of radioactive phosphorus from the roots to the leaves. Delayed treatments with Knop solution shows similar results to those of the direct treatments except at the highest concentration. (auth)

**42772** ABSORPTION INTO THE RABBIT ARTICULAR CARTILAGE. Barnett, C. H.; Palfrey, A. J. (St. Thomas' Hospital Medical School, London). J. Anat., 99: 365-75 (Apr. 1965).

Electron microscope studies were conducted on the distribution of ThO$_2$ particles in the cells of the knee joint of the rabbit after intraarticular injection of Thorotrast. After a dilute suspension of Thorotrast was injected into the knee joint of both immature and young adult rabbits, the animals were exercised and specimens of the femoral articular cartilage taken for electron microscopy up to 2 days after injection. At both ages the ThO$_2$ particles penetrated only about 2 to 3 μ into the cartilage; cells are not normally present at this level, so the particles were seen only in relation to the collagen fibers of the matrix and were not absorbed into the chondrocytes. After 24 hr this superficial layer of 2 to 3 μ appeared to be breaking away from the underlying matrix. Some of the cells in the superficial zone of the cartilage (occupying a depth of about 20 μ) showed break-up of the endoplasmic reticulum, electron-dense granules, myelin bodies, and irregular vesiculation; others showed complete degeneration. Specimens taken 48 hr after injection showed similar changes in the middle zone of the cartilage. Thorotrast interferes with the normal metabolism of the surface cells producing degeneration. This is thought to be the result of the chemical toxicity of the injected material, rather than to its mechanical or radiation effects. To estimate whether radiation damage is responsible, the effects were considered by postulating a layer of thorium dioxide on the surface of the cartilage ~1 μ thick. Calculation then showed that a cell, of diameter 8 μ, at a depth of 20 μ from the surface, will be hit by an α particle once in about every 20 hr. Observations showed that the Thorotrast in fact forms not more than 3% of the superficial 3 μ of the cartilage; if this is taken to reduce the incidence of α particles by a factor of 10, each cell will be hit on the average once every 200 hr. The damage should also be limited to the max range of α particles from Th and its daughters in tissue, which is known to be about 30μ. Since the incidence of α particles is too small and the cartilage is in fact damaged to a greater depth than would be expected, it is unlikely that this is the mechanism for the damage. (BBB)

**42773** PYRUVATE CARBOXYLASE. VI. THE PRESENCE OF TIGHTLY BOUND MANGANESE. Scrutton, Michael C.; Utter, Merton F.; Mildvan, Albert S. (Western Reserve Univ., Cleveland. Univ. of Pennsylvania, Philadelphia). J. Biol. Chem., 241: 3480-7 (Aug. 10, 1966).

The presence of paramagnetic metal ion in pyruvate carboxylase has been shown by the effect of this enzyme on the longitudinal relaxation rate of the protons of water as measured by pulsed nuclear magnetic resonance. The metal ion shows an enhanced effect on the proton relaxation rate ($\epsilon_b = 4.2$) when bound to the enzyme as compared to that of the free metal ion in the presence of denatured enzyme. This observation suggested that the metal ion is manganese, and the presence of manganese in the purified enzyme is confirmed by chemical, neutron activation, emission spectral, and atomic absorption spectral analyses. Quantitative analysis by various methods has given the metal content as 2.5 to 4.3 moles of manganese per mole of enzyme or 0.6 to 1.1 moles of manganese per mole of biotin. $^{54}$Mn is incorporated into pyruvate carboxylase *in vivo*. When the enzyme is isolated from chicken liver mitochondria, a good correlation is obtained between radioactivity and enzymic activity at all stages of purification subsequent to the initial mitochondrial extract. Correlation between total manganese content and enzymic activity has also been shown at various stages of purification. Studies on the $^{54}$Mn-labeled enzyme have shown that release of $^{54}$Mn and reduction in the enhancement of the proton relaxation rate occur only after irreversible denaturation of the enzyme. Neither the $^{54}$Mn content nor the proton relaxation rate is affected by exposure of the enzyme to cold or ethylenediaminetetraacetate. No exchange of the bound metal ion with added manganese can be shown. Although the protein-bound manganese possesses magnetic properties consistent with divalent manganese ion, higher valency states cannot be excluded. (auth)

**42774** IDENTIFICATION OF THYROIDAL IODOAMINO ACIDS BY GEL FILTRATION AND AUTOMATED $^{127}$I DETERMINATION. **Jones, John E.; Shultz, Jeffrey S. (West Virginia Univ., Morgantown). J. Clin. Endrocrinol. Metab., 26: 975-85(Sept. 1966).**

Hydrolysates of thyroid tissue from 4 patients with diverse thyroid disease were subjected to gel filtration on Sephadex G-25. Iodide ($I^-$), monoiodotyrosine (MIT), diiodotyrosine (DIT), triiodothyronine ($T_3$), and thyroxin ($T_4$) were determined both by an automated chemical analysis of $^{127}$I and by $^{131}$I counting. Detection of these compounds by $^{127}$I analysis reliably reflects their presence in the thyroid gland and under certain circumstances may allow a more accurate evaluation of possible iodotyrosine coupling defects than $^{131}$I counting. A portion of the thyroid gland from one of the patients was stored for a prolonged period at −4 C. Gel filtration of a hydrolysate of this stored thyroid tissue gave results similar to those obtained immediately post thyroidectomy. Gel filtration of thyroid hydrolysates offers a simple, reliable, and highly reproducible means of separating iodide and the thyroidal iodoamino acids. (auth)

**42775** STUDIES ON $^{65}$Zn UPTAKE BY EHRLICH ASCITES CANCER CELLS IN VITRO. **Fujii, Shunichi (Gunma Univ., Kiryu, Japan). Kitakanto Igaku, 15: 391-7(Sept. 1965). (In Japanese).**

Ehrlich ascites tumor cells gradually took up $^{65}$Zn from their environment of KRP and 0.9% NaCl medium on incubation at 37°C. Addition of metabolic inhibitors, amino acids, oncostatic preparations, and metal ions, changed the uptake. Uptake occurred more rapidly in the first 20 minutes; thereafter it became slow. 2,4-dinitrophenol and monoiodoacetic acid at final $10^{-3}$ M concentration depressed the uptake. Potassium cyanide markedly increased the uptake in KRP medium, but no changes occurred in medium of 0.9% NaCl. Some amino acids like DL-penicillamine, D-penicillamine, L-histidine, glycine, L-cysteine, and L-glutathione were added to the medium to the final concentration of $10^{-3}$ M. Penicillamine is a strong inhibitor, L-histidine is a mild inhibitor, and others revealed no effect. Mitomycin C at final 1 μg, 10 μg, and 100 μg concentrations, toyomycin at 1 μg and 10 μg, nitromin 100 μg, and tespamin 100 μg concentrations, gave no changes. Only merphyrin at a final 100 μg concentrations inhibited the uptake. $Fe^{3+}$, $Fe^{2+}$, $Co^{2+}$, $Ni^{2+}$, $Mn^{2+}$, $Cu^{2+}$, and $Mg^{2+}$ at final $10^{-3}$ M concentrations inhibited the uptake to various degrees. $Fe^{3+}$ was a particularly powerful inhibitor. At final $10^{-4}$ M concentration, $Ni^{2+}$, $Co^{2+}$ and $Mn^{2+}$, only inhibited the uptake moderately. (auth)

**42776** INVESTIGATION OF A RADIOSENSITIZER BY MEASUREMENT OF THE UPTAKE OF $^{32}$P IN IRRADIATED EXPERIMENTAL TUMORS. **Dragoni, G.; Zucali, R.; Roncoroni, L. (Univ., Milan. Univ., Pavia, Italy). Minerva Radiol., Fisioterap. Radiobiol., 11: 340-5(June 1966). (In Italian).**

The radiosensitizing effect of 5-bromodesoxyuridine was investigated by determining the radiophosphorous uptake in Walker's adenosarcoma, Ehrlich ascites tumor, and in ascites hepatoma in the rat. It was found that the irradiation of Walker's tumor causes a decreased uptake of the radioisotope; this effect is more apparent when radiation follows the intraperitoneal injection of 5-bromodesoxyuridine. In animals with ascites tumors (Ehrlich in the mouse and hepatoma in the rat) the radiation or drug treatment alone also caused a reduction of the radioactivity of the neoplastic growth. On the contrary in animals in which irradiation was preceded by the administration of the radiosensitizer, the radioactivity of the ascitic fluid was appreciably greater. (tr-auth)

**42777** RADIATION-INDUCED INHIBITION OF THYMIDINE INCORPORATION BY MAMMALIAN CELLS IN VITRO. **Smets, L. A. (Univ. of Nijmegen, Netherlands). Nature, 211: 527-8(July 30, 1966).**

Uptake of tritium- or carbon-14-labeled thymidine into DNA is inhibited by ionizing radiation. However, this effect is reversed with increasing concentrations of labeled thymidine or pool size. Cells from bovine liver strain were x irradiated and thymidine incorporation was investigated within a two-hour period following irradiation with 500 R. Cell cultures were incubated in a medium with various concentrations of carbon-14-labeled thymidine. At the end of the two-hour period cells were trypsinized from the vessels and their DNA content isolated. Incorporation rates were expressed as specific activity of the isolated DNA. Radiation resulted in decrease of thymidine incorporation from the medium; the decrease was progressively less pronounced with increasing concentrations of exogenous thymidine. Phosphorus-32 was also used for studying the rate of DNA synthesis after 500 R. No decrease of phosphate incorporation was observed. The competitive inhibition of thymidine incorporation together with an unchanged rate of DNA synthesis can be explained by assuming that the endogenous (and thus non-radioactive) pools of thymidine are augmented after irradiation as a result of DNA breakdown. These breakdown products will compete with labeled substrate for incorporation into DNA and decrease the uptake from the medium in lowering concentration gradients. (H.L.W.)

**42778** DISTRIBUTION OF CESIUM AND RUBIDIUM IN HUMAN BLOOD. **Yamagata, Noboru; Iwashima, Kiyoshi (Inst. of Public Health, Tokyo). Nature, 211: 528-9 (July 30, 1966).**

The cesium-137 content of human blood samples was analyzed. Radiochemical determinations on plasma and erythrocyte fractions gave a 1 : 3 ratio for cesium-137 content of plasma to cells. Stable cesium and rubidium were measured by neutron activation followed by gamma spectrometry in blood fractions. Ninety-eight per cent of the rubidium was located in the erythrocytes. The relative variation of whole blood concentration was much greater for cesium than for rubidium, and the range of rubidium : cesium ratio in individuals was from 5 to 39. The average ratio of the contents of stable cesium in the plasma to that in erythrocytes was 1 : 3. (H.L.W.)

**42779** ASSESSMENT OF BODY CONTENT OF RADIOACTIVE STRONTIUM FOLLOWING CONTAMINATION IN ADULT MEN. **Harrison, G. E. (Radiobiological Research Unit, Harwell, Eng.); Rundo, J. Nature, 211: 774-5 (Aug. 13, 1966).**

A formula, $R_0 = \Sigma_0^5 U/0.5$, for the rapid assessment of body content of radiostrontium is presented where $R_0$ represents the injected dose and $\Sigma_0^5$ U represents urinary excretion of radiostrontium over 5 days. Individual retention equations for five subjects were differentiated with respect to time to give expressions for the excretion rates. For times up to 18 days after intake, the empirical equation $F = 5.4e^{0.13}t$ where F = retention/excretion rate at various times after intake and t is the time in days after exposure, predicted to within ±30% the calculated value for each subject. The expression $7e^{0.13}t$ was used to calculate the factor by which the 24 hr urinary Sr excretion is to be multiplied to give the systemic content at any time up to 18 days after an intake, irrespective of the route of intake. (H.G.D.)

**42780** $^{90}$Sr IN BEAGLE HAIR. Della Rosa, R. J.; Peterson, G.; Gielow, F. (Univ. of California, Davis). Nature, 211: 777-9(Aug. 13, 1966).

The concentration of $^{90}$Sr was assayed in the hair of beagles while the animals were on a chronic ingestion regimen of the radionuclide and for up to one year following cessation of the $^{90}$Sr feedings. Hair concentrations were correlated with $^{90}$Sr/Ca ratios for plasma during the same periods. During the course of the chronic ingestion of the radionuclide, the ratios of $^{90}$Sr/Ca for the plasma and hair were essentially equal and constant at 1.5 μC/Ca with the observed ratio of 0.45 for all dietary levels. The value of the observed ratio of bone/diet in the beagle was found to be about 0.45. (H.G.D.)

**42781** CORRELATION OF $^{210}$Pb WITH $^{90}$Sr IN HUMAN BONES. Blanchard, Richard L. (Robert A. Taft Sanitary Engineering Center, Cincinnati). Nature, 211: 995-6(Aug. 27, 1966).

Lead and strontium are deposited in the skeleton of the human body; thus a correlation may exist in the bones between lead-210 and strontium-90. Samples of vertebras from 14 infant children who died between the ages of 3 days and 12 months in the vicinity of Cincinnati, Ohio, were analyzed for lead-210. The strontium-90 concentrations were determined at the Northwestern Radiological Health Laboratory in Winchester, Mass. The lead-210 content in the bone samples was determined by dissolving a 5 to 10 g sample of bone ash in 0.1 N HCl, depositing the polonium-210 from the sample on a polished nickel planchet. The lead-210 activity was then calculated from the polonium-210 alpha activity. The calcium content of the bone samples was obtained by precipitating the calcium as the oxalate with oxalic acid at a pH of 2.5–3, dissolving the precipitate in sulfuric acid and titrating the calcium with a standardized solution of potassium permanganate. The average lead-210 and strontium-90 concentrations in these samples were 0.133 and 2.19 pC/g calcium, respectively. The average lead-210/strontium-90 ratio was 0.068. Lead-210 and strontium-90 concentrations were also obtained for a set of 18 vertebra samples of persons between 5 and 22 years of age who had resided in New Hampshire, Vermont, and Massachusetts. For this set of samples the linear correlation coefficient was calculated to be 0.67. The results indicate that a correlation exists between lead-210 and strontium-90 in the human skeleton. They also demonstrate the similar behavior of lead-210 and fission products in our environment. The relative dose, lead-210/strontium-90 delivered to infant bones, based on the average lead-210/strontium-90 activity ratio, was calculated to be 3.4. (H.L.W.)

**42782** RESPONSE TO THE RADIOTRIOLEIN TEST IN ADULTS AND AGED PERSONS. Martinenghi, C.; Riccardi, A.; Sanvito, R.; Baraldi, C. (Univ., Milan). Nunt. Radiol., 31: 1185-96(Nov. 1965). (In Italian).

Metabolism of $^{131}$I-labeled triolein was studied in a group of patients over 65 years of age and compared with a group under 65. Radioactivity was measured as a function of time in plasma, urine, and feces at intervals up to 96 hrs post-ingestion. Significant differences were not found in samples from the two age groups. Fecal values were determined both separately and simultaneously with plasma or urine values; however, the latter method was more reliable. The study contributed information on the digestive function of fats, as well as $^{131}$I distribution in the body, and changes in the water-saline balance in the body. (H.G.D.)

**42783** RADIOBIOLOGICAL PARAMETERS OF ACCUMULATION AND ELIMINATION OF RADIOACTIVE PHOSPHORUS BY INHALATION AND PERORAL PENETRATION OF RADIOACTIVE COMPOUNDS. Pugachevskii, V. P. (Scientific-Research Inst. of Industrial Hygiene and Occupational Diseases, Kiev). Radiobiologiya, 6: 143-5(1966). (In Russian).

Two groups of rats received single injections of $^{32}$P in the form of a solution of $Na_2H^{32}PO_4$ administered at the rate of 0.2 ml with an activity of 2 μC per animal with the aid of a peroral probe or through the use of an inhalation chamber that provided for the penetration of 2 μC of $^{32}$P per animal. The animals were killed at various times after the administration of $^{32}$P and the contents of $^{32}$P in organs and tissues were determined. Results showed that the means of administration of $^{32}$P did not influence phosphorus metabolism. Results are included for the calculations of the biological half-life of $^{32}$P in rat tissues. (C.H.)

**42784** A CONTRIBUTION TO THE CONTROVERSIAL HEMATOPOIETIC STEM CELL FUNCTION OF LYMPHOID CELLS OF THE BLOOD. AUTORADIOGRAPHIC INVESTIGATION ON DOG. Keiser, G.; Cottier, H.; Bryant, B. J.; Bond, V. P. (Univ., Zurich. Univ., Bern. Brookhaven National Lab., Upton, N. Y.). Schweiz. Med. Wochensch., 95: 1421-4(1965). (In German). (BNL-10408).

The migration, fate, and turnover of lymphoid cells in blood and bone marrow of irradiated and non-irradiated dogs were studied by serial autoradiography. The hind legs were clamped during plasma clearance time of $^3$H-thymidine injected into an anterior vein. In irradiated dogs, the $^3$H-thymidine injection procedure was carried out during early recovery after 250R of whole body x-irradiation. Conclusive evidence of transformation of hematogenous bone marrow lymphoid cells into hemopoietic precursors was not found. However, transformation of a few lymphoid cells into hemopoietic cells cannot be ruled out. The data from a dog in the very early recovery phase strongly indicated such a transformation. (auth)

**42785** INVESTIGATIONS ON METABOLISM IN THE EPI- AND METAPHYSIS AFTER LOCAL X IRRADIATION. PART VIII. RELATION OF THE GENERAL REACTION IN BONE SYSTEMS TO OTHER TISSUES. Babicky, Arnost; Kolar, Jaromir; Vyhnanek, Lubos (Univ., Prague. Biologischen Institute, Tschechoslowakischen Akademie der Wissenschaften, Prague). Strahlentherapie, 130: 349-56 (July 1966). (In German).

Further investigations were done in young white rats concerning the generalized metabolic reaction of the skeleton upon a local radiation damage. An attempt was made to determine the course of this reaction in mesenchymal tissues other than bone and to even exclude a reaction. Proof of such a reaction in the tendons seems to support the hypothesis, that the true nature of this general reaction is based upon the reactivity of the total mesenchymal tissue system. This is of importance in investigating the influences of ionizing radiation upon the total organism. (tr-auth)

**42786** EXCRETION OF RADIONUCLIDES (INVESTIGATIONS ON RADIOCESIUM). Nigrovic, Vladimir; Bohne, Felicitas; Madshus, Kjell (Kernforschungszentrum, Karlsruhe. Norsk Hydro's Institutt for Kreftforskning, Oslo). Strahlentherapie, 130: 413-19(July 1966). (In German).

Chronic feeding of ferric cyanoferrate (II) (BB) increases markedly the fecal excretion of parenterally administered carrier-free $^{137}$Cs in rats. The biological half-life of $^{137}$Cs is diminished by 50%. The temperature at which the BB precipitate is dried is relevant for its efficacy. The maximum inhibition of the enteral absorption of $^{137}$Cs is achieved by BB dried at room temperature. One year's storage does not impair the efficacy of BB. No toxic side-effects and no impairment of growth were observed in young rats maintained for 120 days on a diet containing 1% BB. Questions of therapeutic use of BB in humans are discussed. (auth)

**42787** STUDIES ON THE NITROGEN METABOLISM IN FROG LIVER AFTER WHOLE-BODY IRRADIATION. V. CHANGES IN THE COMPOSITION OF FROG SERUM

PROTEINS AFTER WHOLE-BODY IRRADIATION. Lebez, D.; Antonijevic, M.; Furlan, M. (Josef Stefan Nuclear Inst., Ljubljana, Yugoslavia). Strahlentherapie, 130: 437-9(July 1966).

Paper electrophoresis of frog serum protein was carried out 1, 2 and 5 days after whole-body gamma-irradiation with a dose of 650 R. A considerable increase in the concentration of total nitrogen and albumins was observed in the serum of irradiated animals. The demonstrated alterations strikingly differ from those which are induced by whole-body irradiation in mammals. (auth)

**42788** IMMEDIATE REACTIONS OF PERIPHERAL BLOOD AND BONE MARROW FOLLOWING LETHAL WHOLE-BODY IRRADIATION. Loehr, Eberhard (Univ., Marburg, Ger.). Strahlentherapie, 130: 528-43(Aug. 1966). (In German).

The influence of lethal amounts of whole-body irradiation upon energy metabolism of the peripheral blood and the bone marrow was investigated in rats. Blood (erythrocytes) obtained by blood exchange during or immediately after a lethal radiation dose showed no significant changes in the content of the following nucleotides investigated: ATP, ADP, AMP, NAD, and NADP. There were no significant activity changes in the glycolytic enzymes investigated. The redox-buffer-system, oxidized/reduced glutathione, was decreased in the erythrocytes. Total body irradiated rats had a longer survival time after receiving a blood transfusion. Distinct disturbances in the nucleotide metabolism were found in the bone marrow immediately after irradiation, especially a decrease in ATP was found. Furthermore, a significant decrease in enzyme activities (especially for hexokinase and glucose-6-phosphate dehydrogenase) were found immediately after irradiation. These are disturbances which are caused mostly by ion-displacements of $Ca^{++}$ and $K^{+}$ in the bone marrow. The disturbances in the enzymes are mainly a result of the indirect radiation effect. (auth)

**42789** BEHAVIOR OF RADIOACTIVE ZINC-CHELATES IN MAMMALIAN ORGANISMS. Catsch, Alexander; Le, Du Khuong (Kernforschungszentrum, Karlsruhe, Ger.). Strahlentherapie, 130: 557-66(Aug. 1966). (In German).

The retention of $^{65}$Zn by the rat as influenced by isotopic dilution and different doses of the Ca- and Zn-chelates of EDTA and DTPA was studied. Stable carier leads to a slightly diminished retention. Delayed administration of Zn-chelates is more effective in mobilizing $^{65}$Zn from the body than Ca-chelates. Consequently isotopic exchange has to be assumed. The analysis of experiments with Zn-chelates labeled by $^{65}$Zn indicates that the retention of $^{65}$Zn is due to isotopic exchange as well as to a genuine retention of Zn. The $^{65}$Zn-retention in this case is markedly suppressed by a relatively small excess of free ligand. Pronounced differences in the efficacy of EDTA and DTPA suggest a different metabolic behavior of the chelating agents. The implication of these findings for the therapeutic usage of Zn-DTPA is discussed. (auth)

**42790** GAS PERMEABILITY OF SKIN UNDER DIFFERENT CONDITIONS. von Diemar, Burkhard (Univ., Giessen, Ger.). Strahlentherapie, 130: 624-30(Aug. 1966). (In German).

The gas permeability of the skin was examined in the rat tail by using radon-222. Radon, dissolved in the bath-water diffused through the skin of the tail into the blood circle an. was excreted through the lungs. The radon concentration was measured in the exhaled air. An increase of the radon diffusion through the skin was obtained by increased temperature of the bath-water and by uv-irradiation. In order to obtain further information about the transportation of radon in the animal body, the radon content of tail and body was determined. (auth)

**42791** A STUDY OF $^{65}$Zn DISTRIBUTION IN THE PROTEIN FRACTIONS OF GUINEA-PIG SERUM. Racoveanu, N.; Stanciulescu, V.; Truta, E. Stud. Cercet. Biochim., 8: 465-71(1965). (In Rumanian).

Investigations on $^{65}$Zn distribution between different serum protein fractions were carried out on guinea pigs intraperitoneally injected with 5 $\mu$Ci of $^{65}$Zn($^{65}$ZnCl$_2$). Blood pooled by heart puncture was subjected to dialysis, centrifugation, fractionation on the DEAE-cellulose column and electrophoresis. Determinations and spectrophotometrical readings were performed on the radioactivity of the collected fractions and the protein extinction, respectively. Two hours after administration, a stable $^{65}$Zn serum protein bond was revealed, and no pH 8.6 dialysis was exhibited. The serum protein fractions showed different affinities to $^{65}$Zn, viz.: the $\alpha_2$-globulin fraction showed 25%, bond albumins exhibited almost the same affinity as $\alpha_2$-globulins, $\alpha_1$-globulins displayed high specific activity, while $\beta$- and $\gamma$-globulins did not bond $^{65}$Zn. On the other hand a stable bond was established between red cell soluble proteins and $^{65}$Zn. (auth)

**42792** DEPENDENCE OF RADIUM CONTENT IN VEGETABLES AND CEREAL CROPS ON ITS CONCENTRATIONS IN SOILS. Mukhin, I. E.; Pavlova, Zh. K.; Nagovitsina, L. I. Vop. Pitaniya, 24: No. 2, 11-14(Feb. 1965). (In Russian).

Figures showing estimation of the radium-226 content in vegetables and cereal crops grown in soils containing different amounts of this radio-element are presented. The accumulation of radium in vegetable foodstuffs was noted to be contingent not only upon the radium-226 concentration in the soil, but also on the physical and chemical properties of the latter. This point will be the object of further investigations. (auth)

**42793** INVESTIGATION OF THE METABOLISM OF CERTAIN VITAMINS IN DOGS FED MEAT PRODUCTS PASTEURIZED BY GAMMA IRRADIATION. Shillinger, Yu. I.; Kachkova, V. G.; Maganova, N. B. Vop. Pitaniya, 24: No. 2, 40-6(Feb. 1965). (In Russian).

The metabolism of radiolabile vitamins (B$_1$, B$_6$, K, E) was studied in dogs fed radiopasteurized beef and pork. The study, which continued for one and a half years, was made on 12 dogs (6 experimental and 6 control). The following analyses of vitamins were carried out: thiamine —urine content and pyroracemic acid content of blood and urine; pyridoxine —xanthuronic acid content in urine following L-tryptophane loading; vitamin E —erythrocyte resistance to dialuric acid; vitamin K—prothrombin time. The results did not differ materially in experimental and control dogs for the duration of the study. The feeding of animals on radiopasteurized meat did not affect the radiolabile vitamin supply of the dogs. (H.L.W.)

**42794** RELATIONSHIP BETWEEN INGESTION, EXCRETION, AND ACCUMULATION OF FALLOUT $^{137}$Cs IN MAN ON A LONG-TERM SCALE. **Fujita, M.; Yabe, A.; Akaishi, J.; Ohtani, S. (Japan Atomic Energy Research Inst., Tokyo). 15p. (CONF-650616-21). ORAU. Gmelin, AED-CONF-65-153-41.**

**From Health Physics Society, Annual Meeting, Los Angeles.**

Investigations were made to follow the ingestion, excretion and accumulation of fallout $^{137}$Cs in 5 volunteers on a long-term scale, and, at the same time, using the data so obtained to determine the biological half-life of Cs as well as the fraction of this nuclide in urine of that in total excreta. The dietary intake, daily excretion, and body burden of $^{137}$Cs increased since 1962 to the maxima in the middle of 1964, but thereafter the levels began to decrease. The relation between the body burden and the total excretion gave the biological half-lives of from 57 to 138 days. The mean value was 80 days. It was noticed that the biological half-lives somewhat varied between and within individuals. The values of urine divided by total excreta ranged from 0.74 to 0.91, and the mean value was 0.86 in the subjects. The corresponding values of K are also studied and they are compared with those of $^{137}$Cs. (auth)

**42795** THE USE OF ISOTOPES IN SOIL ORGANIC MATTER STUDIES. **Report of the FAO/IAEA Technical Meeting, Brunswick-Voelkenrode, 9–14 September, 1963. Special Supplement to the Journal of Applied Radiation and Isotopes. New York, Pergamon Press, 1966. 518p.**

This book is a report of the technical meeting organized by the Food and Agriculture Organization of the United Nations and the International Atomic Energy Agency, with the scientific cooperation of the International Soil Science Society, Commission II (Soil Chemistry), held by courtesy of the Government of the Federal Republic of Germany at the Agricultural Research Centre, Brunswick-Voelkenrode, from 9 to 14 September, 1963. The program included such topics as the role of organic matter in soil productivity, the influence of soil organic matter on plant nutrition and metabolism, the chemistry of humic substances, the role of micro-organisms in the formation and decomposition of organic compounds in soil, the decomposition of plant tissue in soil, the humification of plant and microbial tissue in soil, soil organic nitrogen, and experimental techniques for using isotopes in studies of soil and soil organic matter. Forty-five papers were presented. Each individual topic was introduced by a speaker who reviewed the field of work concerned. Special emphasis was given to the future role of isotopes in soil organic matter research and the various isotopes, mainly carbon-14, tritium, and nitrogen-15, that would be of major importance in such investigations. (H.L.W.)

**42796** VOPROSY EKSPERIMENTAL'NOI I KLINICHESKOI RADIOLOGII. VYPUSK II. (Problems of Experimental and Clinical Radiobiology. Issue II.). Shantyr, V. I.; Arnautov, A. K.; Burlachenko, G. A.; Vishnevetskaya, E. M.; Zarkevich, N. F.; Lemberg, A. A.; Pokrovskii, S. A. (eds.). Kiev, Zdorovya, 1966. 235p.

Forty-four articles are included on clinical studies of the biological effects of high energy radiation. Studies were made of the early organism reactions to bremsstrahlung from various 3.5 Mev accelerators on the ribonuclease activity in subcellular fractions of liver and the reaction of desoxyribonucleic acid and desoxyribonuclease. Also included are papers on metabolism in animals during acute radiation sickness; content of amino acid in the bone marrow; hydration of tissues; phospholipid metabolism in denervated muscles, endocrine organs, and the central nervous system. A larger portion of the papers are devoted to diagnosis and therapy using radioisotopes. Specific papers include: uses of $^{32}$P in diagnosis of swollen skin, mucous membrane of the throat, and intestines; use of iodine-131 in thyroid gland diagnosis and the use of $^{32}$P, $^{131}$I, $^{198}$Au, and $^{111}$Ag for treatment of various sicknesses; diagnosis and treatment of bladder ulcers following combined radiotherapy of cancer of the pelvis. The waste disposal and protective measures in hospitals using radioisotopes are also discussed. (R.V.J.)

**42797** RETENTION, DISTRIBUTION AND ABSORPTION OF INHALED PARTICLES. Pircher, Felix J.; Knight, Conrad M.; Barry, William F.; Reeves, Robert J. (Duke Univ. Medical Center, Durham, N. C.). 14p. (CONF-651139-1). ORAU. Gmelin, AED-CONF-65-335-2.

From Radiological Society of North America, 51st Annual Meeting, Chicago.

The retention, distribution and absorption of labeled human serum albumin, nebulized in a Bird micronebulizer and inhaled with the aid of a Bird Mark VII respirator was measured in 4 normal subjects and in 2 patients with total laryngectomies. The results indicate that an average of 14% of the total nebulized dose is retained in the lungs and an average of 10.5% outside the lungs. The dose from $^{131}$I HSA to the lungs is approximately 5.4 rads, to the whole body 150 mrads. With $^{99m}$Tc, the doses are reduced by a factor of 15. In more than 70 examinations of patients with lung disease, areas of ventilation deficits could be detected and localized by radioisotope scanning. The best results were obtained in patients inhaling the aerosol over a period of 20 minutes while breathing slowly and deeply, and with the respirator set at a flow rate of 6 to 7 l/min and a pressure of 10 to 15 cm H$_2$O. The chest scans were of better quality when delayed for 1 to 2 hours. (auth)

## Radiation Effects on Biochemicals

***See also* CHEMISTRY — Radiation Chemistry**

**42798** (NP-16224) UEBER DIE WIRKUNG DER ALPHA- UND BETA-AMYLASEN AUF BESTRAHLTE STAERKE. (Studies on the Action of Alpha and Beta Amylases on Irradiated Starch). Tollier, M. Th.; Guilbot, A. (CERDIA, Massy (France). Laboratoire de Biochimie et Physico-Chimie des Cereales). [nd]. 20p. Dep. mn.

The action pattern of alpha and beta amylolysis of native potato and corn starch was investigated as a function of irradiation conditions of these products. The radiation dosage for two hydrations at radiation time was studied as well as the role of starch hydration while irradiated, for the same dose of 25 MR. The results are discussed and related to other investigations made on the same products, concerning the action of gamma radiation on some characteristics of the starch granule, such as dispersibility in alcohol 80°GL and in water and the number of modified glucose units. It was found that the action pattern of the alpha and beta amylolysis at the native state after radiation depends above all on: the dispersibility state of the macromolecular part and more generally on the modification of the structure of the starch granule, which facilitates the contact between the enzyme and the substrate; and the proportion of modified anhydro-glucose units in the macromolecule, which block the enzyme action. (auth)

**42799** (UCB-34P95-1) RADIATION OF HEME PROTEINS. Progress Report, October 1, 1965–September 30, 1966. Brown, W. D. (California Univ., Berkeley. Inst. of Marine Resources). Contract AT(11-1)-34. 6p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Developments are reported for studies on: radiation effects on splitting of peptides and amino acids from myoglobins; production of malonaldehyde in irradiated materials and the reactivity of malonaldehyde with irradiated proteins; and effects of pH on rates of oxidation of oxymyoglobins and oxyhemoglobins. (P.C.H.)

**42800** (ORNL-tr-1289) THE INFLUENCE OF ULTRAVIOLET RADIATION ON THE NUCLEIC ACID CONTENT IN PARAMECIUM CAUDATUM. [PART] I. Samoilova, K. A.; Ovchinnikova, L. P. Translated for Oak Ridge National Lab., Tenn., from Sb. Rabot, Inst. Tsitol., Akad. Nauk SSSR, No. 3, 145-53(1963). 17p. Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.60 fs, $0.80 mf.

Cytochemical studies were made on a single clone of *Paramecium caudatum* that was exposed to uv (primarily 2537 Å) for 5 min. Quantities of DNA and RNA were determined with a microphotometer. Ultraviolet radiation did not cause considerable changes in the quantity of DNA in *Paramecium caudatum*. DNA synthesis probably does not cease during radiation sickness of Infusoria, but the rate drops sharply. The macronuclei of irradiated organisms were 3.5 times as large as those of the controls at the time of cell death, and DNA distribution was irregular in the macronuclei. The quantity of cytoplasmic RNA diminished by a factor of 3 during the course of radiation sickness. RNA synthesis was disturbed in the first days after irradiation and ceased in the second phase of UV sickness. It was concluded that one of the principal reasons for the death of uv-irradiated Infusoria is the arrest of RNA synthesis. (auth)

**42801** INFLUENCE OF THE ADRENAL CORTEX ON CREATINE EXCRETION INDUCED BY IRRADIATION IN THE RAT. Piwonka, Guillermo; Talesnik, Jaime (Univ., Chile, Santiago). Arch. Biol. Med. Exp., 2: 92-6(1965). (In Spanish).

Adult male rats (180 to 200 g body weight) kept in metabolic cages for adaptation prior to the experiments were adrenalectomized, and drinking water with 5% sucrose was administered *ad libitum*. Urine was collected in 24-hr periods, and body weight, water, and food consumption were registered every day. Creatinine and creatine were determined in the urine. After adrenalectomy two groups of rats received daily injections of either cortisol (1 mg/100 g body weight) or deoxycorticosterone acetate (DOCA, 1 mg/100 g body weight). After 72 hr after adrenalectomy each group was subdivided into two; the first submitted to irradiation and the second was not. A $^{137}$Cs source that produced a dose rate of 7.2 R/min was used to give a total-body irradiation dose of 720 R. Results showed that after adrenalectomy there was a progressive increase in the creatine excretion in the cortisol-treated rats while in the DOCA-treated rats the creatinuria was lower and transient. After irradiation there was a sharp increase in the creatinuria of rats that received either type of steroid treatment, but the cortisol-treated rats reached a much higher level than those that received DOCA. There were no statistical differences between the animals subjected to irradiation and those sham-irradiated. (TSAT)

**42802** THE SITE OF ACTION OF CYSTEAMINE IN IRRADIATED BACTERIA: AN ELECTRON SPIN RESONANCE STUDY. Baker, A.; Ormerod, M. G.; Dean, C. J.; Alexander, P. (Royal Military Coll. of Science, Shrivenham, Eng. Royal Cancer Hospital, London). Biochim. Biophys. Acta, 126: 37-42(Sept. 5, 1966).

Electron spin resonance spectra showed that radicals produced in *Escherichia coli* B/r and *Micrococcus radiodurans* by exposure to $\gamma$ rays at −195° undergo a series of changes on warming. Cysteamine modifies these reactions in a characteristic manner, but the full effect is only seen if the bacteria are ruptured by mechanical methods prior to the addition of cysteamine. With intact *M. radiodurans* cysteamine has almost no effect on the ESR spectra seen after irradiation, while with *E. coli* B/r cysteamine already has some influence before irradiation possibly because the cells are damaged to some extent by freeze-drying. The data are interpreted as showing that cysteamine does not penetrate into the interior of non-metabolizing bacteria, yet it protects against the lethal action of ionizing radiations under these conditions. Physicochemical experiments had shown earlier that main-chain scission of DNA extracted from irradiated bacteria was not protected by cysteamine. The hypothesis is advanced that cysteamine protects a metabolic repair system of DNA which is situated at or near the cell membrane, and in this way makes the restitution of DNA lesions more efficient in irradiated bacteria. (auth)

**42803** HEAT AND LIGHT-INDUCED PHOSPHORESCENCE OF PROTEINS AND AROMATIC AMINO ACIDS SUBJECTED TO ULTRAVIOLET RADIATION. Vladimirov, Yu. A.; Aksentsev, S. L.; Olenev, V. I. (Inst. of Biological Physics, Moscow). Biofizika, 10: 614-18(1965). (In Russian).

A method of freezing uv-irradiated experimental materials at 77°K made it possible to stop the photochemical process at the states of the primary products and made study of them easier. UV-irradiation at 77°K gave two photoproducts, one responsible for thermoluminescence of proteins and the other responsible for the fading of protein luminescence. Heat and visible-light-induced phosphorescence were detected in ultraviolet-irradiated proteins and the aromatic amino acids, tryptophan and tyrosine. The time of fading and the spectral composition of the induced and the ordinary phosphorescence of these compounds at 77°K were measured. The reciprocals of the lifetime of ordinary and induced phosphorescence, $\tau$, for tyrosine, tryptophan, and chymotrypsin was measured and tabulated. The values of $\tau$ for induced phosphorescence were, as a rule, close to the $\tau$ of ordinary phosphorescence, but always a little larger in magnitude. Spectral analysis of ordinary and induced phosphorescence of tryptophan and tyrosine showed that the band of induced phosphorescence was shifted slightly to the longwave side as compared to ordinary phosphorescence. Because of the similarities of the afterglows, it was predicted that scintillation proceeds from the third level of the original aromatic amino acid molecule. It was found that light-induced phosphorescence differed essentially from ordinary phosphorescence; in particular, induced phosphorescence may be antitoxic. The curves of luminescent fading in heat-induced phosphorescence followed, as in light-induced phosphorescence, in relation to a first order reaction. The value for $\tau$ of heat-induced phosphorescence was found to match the $\tau$ of ordinary phosphorescence, except that in alkaline solution of tyrosine, fading time of induced phosphorescence greatly exceeded that of ordinary phosphorescence. The influence of the intensity of light on the forward reaction of the accumulation of a photoproduct under the influence of ultraviolet radiation and or the reverse reaction of the destruction of this product was studied. The speed of the forward reaction was directly proportional to the intensity of ultraviolet irradiation. The speed of the reverse reaction was proportional to the square root of the intensity of the acting light. The forward photochemical reaction proceeds according to a single quantum mechanism, but the following heating or illumination by visible light proceeds to the recombination of photoproducts and scintillation from the triplet state of the original amino acid. (ATD)

**42804** EFFECT OF GASES ON THE THERMOLUMINESCENCE AND PROLONGED POSTLUMINESCENCE OF FROZEN SOLUTIONS OF PROTEINS AND AROMATIC AMINO ACIDS IRRADIATED WITH ULTRAVIOLET LIGHT. Roshchupkin, D. I. (Moscow State Univ.). Biofizika, 11: 167-8(Jan.-Feb. 1966). (In Russian).

The thermoluminescence and postluminescence (afterglow) of frozen solutions of tryptophan, tyrosine, and chymotrypsin, placed into quartz tubes and irradiated with ultraviolet light while the tubes were kept in liquid nitrogen, was studied. The intensity of thermoluminescence of trypotophan was the same during irradiation in air as in argon. On irradiation of tryptophan, tyrosine, and chymotrypsin *in vacuo*, the intensity of thermoluminescence and postluminescence was lower by two orders of magnitude than that observed on irradiation in air. Measurement of temperatures in the frozen solutions by means of a thermocouple placed in the tubes indicated that the temperature of the solutions in evacuated tubes submerged in liquid nitrogen was higher by almost 20°C even 5 to 10 min after submersion than that of the solutions in the tubes filled with air. Apparently heat transfer from the solutions was more difficult in the evacuated tubes than in the tubes filled with Ar or air, in which the temperature of the solutions rapidly decreased to 77°K, so that during irradiation *in vacuo* the solvated electron and the cation-radical recombined. Apparently the formation of a solvated electron did not depend on the presence of $O_2$ and cannot be assumed to be affected by the presence of any other gas; the effect of gases in increasing the intensity of luminescence is due to more rapid cooling of the solutions to 77°K. (ATD)

**42805** EFFECTS OF TOTAL X IRRADIATION ON THE GLYCOPROTEIN CONTENT OF THE BLOOD SERUM IN NORMAL AND HYPOTHYROID ANIMALS. Oletskii, E. I. (Minsk Medical Inst.). Byull. Eksp. Biol. Med., 60: No. 8, 54-6(Aug. 1965). (In Russian).

Single whole-body doses (600 R) of x rays increased $\alpha_1$-glycoproteins and decreased $\alpha_2$- and $\beta$-glycoproteins in rats 88 to 90 hrs post-irradiation. Hexose levels were unchanged by irradiation of normal and hyperthyroid rats. Electrophoretic distribution of glycoproteins in serum were not affected in irradiated hyperthyroid animals. (H.G.D.)

**42806** DISTURBANCE IN THYMINE DECAY IN IRRADIATED RATS. Mazurik, V. K. Byull. Eksp. Biol. Med., 60: No. 12, 43-8(Dec. 1965). (In Russian).

The dynamics of thymidine, $\beta$-aminoisobutyric acid (BAIBA), and desoxyuridine excretion were studied in rats following whole-body x irradiation and injection of 6 mcM of thymidine. It was found that irradiation causes a sharp increase in the excretion of desoxynucleosides and BAIBA attaining the maximum in 12 hours after irradiation. Subsequent reduction was rapid. It was shown that an additional thymidine load in an irradiated animal body causes a disturbance in the recovery of thymidine decay. This disturbance is characterized by the absence of increase in BAIBA excretion within the first 12 hours of irradiation in spite of thymine excess in the body and by a decrease in the effectiveness of conversion of injected thymine into BAIBA from the normal 11.6 per cent to the 2.5 per cent after irradiation. It is inferred that disturbance in thymidine decay in rats with radiation sickness is apparently determined by a considerable decrease in the effectiveness of the restorative way of thymine degradation in the early hours of irradiation. (auth)

**42807** EXCRETION OF THYMIDINE: DESOXYURIDINE AND $\beta$-AMINOISOBUTYRIC ACID IN RATS FOLLOWING IRRADIATION AND THYMIDINE INJECTION. Mazurik, V. K. Byull. Eksp. Biol. Med., 61: No. 2, 45–50(Feb. 1966). (In Russian).

The excretion of thymidine, desoxyuridine and $\beta$-aminoisobutyric acid (BAIBA) in rat urine 6, 12, 24, and 48 hours after irradiation with 650 R and injection of 6 $\mu$M of thymidine was studied. It was shown that thymidine injection to intact animals did not change the excretion of this desoxynucleoside during the first 24 hours but caused a three-fold increase in BAIBA excretion reaching a maximum 12 hours after injection. Irradiation of animals led to a sharp, multiple increase in thymidine excretion with urine during the first 12 hours followed by a reduction to a certain level, which, however, was still above the normal. At the same time, BAIBA excretion during the first 6 hours after irradiation decreased 50 per cent, then rose 100 per cent above normal by the 12th hour, and returned to normal by the 24th hour. The excretion of desoxyuridine after irradiation was increased in all periods of investigation. As a result of injection of thymidine to irradiated animals the BAIBA level which was decreased during the first 6 hours after irradiation did not exceed the normal level in 12, 24, and 48 hours after irradiation. It is inferred that the increased excretion of thymidine in irradiated rats is due to a disturbance in the conversion of thymidine and into BAIBA and intensified DNA decay. (auth)

**42808** INACTIVATION OF 17-OXYCORTICOSTEROIDS IN THE LIVER OF HEALTHY DOGS AND DOGS EXPOSED TO IONIZING RADIATION. Fedotov, V. P.; Rynkova, N. N. Byull. Eksp. Biol. Med., 61: No. 2, 50-3(Feb. 1966). (In Russian).

Experiments on angiostomized dogs were made to study the capacity of the liver to inactivate corticosteroids. The intensity of retention of free 17-oxycorticosteroids by the liver was estimated from the difference in their level in the blood collected from the portal and hepatic veins. It was found that the liver, even under the conditions of physiological rest, retains on the average 67.7 per cent of 17-oxycorticosteroids supplied to it with the blood from the portal vein. The increase in the concentration of hormones in the blood effected by means of injection of cortisone activates the hormone-fixing function of the liver. Irradiation of animals with gamma rays reduces the intensity of retention of corticosteroids in the liver to 20 to 30 per cent. (auth)

**42809** SELECTIVE INACTIVATION OF TRANSFER RIBONUCLEIC ACID. Liao, Shutsung; Sagher, Daphna (Univ. of Chicago). J. Biol. Chem., 241: 3949-54(Sept. 10, 1966).

Horseradish peroxidase in the presence of hydrogen peroxide selectively inactivates the amino acid acceptor activity of certain Escherichia coli transfer ribonucleic acids. Lysine acceptor activity was inactivated to the largest extent by the peroxidase treatment. Acceptor activity for isoleucine, tyrosine, histidine, and alanine was also affected, but to a lesser extent. Amino acid acceptor activity of six other amino acids tested was unaffected. The acceptor activity of rat liver transfer ribonucleic acids for all amino acids tested was insensitive to the peroxidase treatment. The peroxidase treatment did not appear to inactivate the functional sites required for lysyl transfer from E. coli transfer ribonucleic acid into polypeptide linkages in the presence of polyadenylic acid and a bacterial ribosomal system. Ultraviolet irradiation, unlike peroxidase treatment, inactivated to different extents various amino acid acceptor activities of cytoplasmic soluble ribonucleic acids from either E. coli or rat liver. (auth)

**42810** OXIDATIVE PHOSPHORYLATION IN FRACTIONATED BACTERIAL SYSTEMS. XXII. THE EFFECT OF NEAR ULTRAVIOLET IRRADIATION ON THE SUCCINATE OXIDASE PATHWAY OF MYCOBACTERIUM PHLEI. Kurup, C. K. Ramakrishna; Brodie, Arnold F. (Univ. of Southern California, Los Angeles. Los Angeles County General Hospital, Los Angeles). J. Biol. Chem., 241: 4016-22(Sept. 10, 1966).

The succinate oxidase activity of Mycobacterium phlei was sensitive to irradiation with light at 360 m$\mu$. The loss of activity was due to a lesion occurring in the electron transport chain between the flavoprotein and cytochrome b regions. The activity lost was not restored by addition of vitamin $K_1$ or other cofactors but could be restored by the addition of the supernatant fraction. The factor responsible for the restoration of the succinate chain has been purified. It was sensitive to heat and irradiation and appeared to be protein in nature. It activated both oxidation and phosphorylation in irradiated particulate systems. The proteins which restored the two activities could not be separated. (auth)

**42811** THE POSSIBILITIES OF THE RADIODECONTAMINATION OF THE SKIN BY ULTRASONICS. Gligorijevic, J.; Jankovic-Zagorcic, A. Mededel. Landbouwhogeschool Opzoekingssta. Staat Gent, 30: 1215-21(1965). (In French).

Ultrasonic radiations of therapeutic quality (0.8 to 3 Mc and 0.5 to 2.4 W/cm$^2$) applied over a period of 2.5 to 10 min with different circumstances (distilled water, 5% carrier isotope, 1% $H_3BO_3$, 1% $CaCl_2$, 1% $NaHCO_3$ or $Na_2S_2O_3$) produced significant decontamination effects. Filter paper soaked with $^{131}$I, $^{90}$Sr, or $^{32}$P was placed on the skin on white rats for about 40 min (until it dried) prior to ultrasonic exposure. Ninety-six per cent of the initial $^{32}$P activity and 86% of the initial $^{131}$I activity was removed by ultrasonic irradiation. By irradiating prelabeled skin decontaminated together with water, 27% of the retained activity is removed as residue. Ultrasonic decontamination of skin contaminated with $^{90}$Sr is in the order of 80% of the initial activity, when this is effected in the presence of 1% $CaCl_2$. The effects of ultrasonic decontamination are considerably reduced (59%) if the skin is treated with protective ointments before contamination. Under the same experimental conditions, the activity is reduced 80% by removing the ointments with ether swabs. (tr-H.G.D.)

**42812** PHOTOREVERSAL OF ULTRAVIOLET LIGHT INDUCED MUTATION, LETHALITY AND DAMAGE TO NUCLEIC ACID FORMATION IN BACTERIA. Doudney, C. O. (Univ. of Texas, Houston). Mutat. Res., 3: 280-97(Aug. 1966).

With low uv doses, dark repairable blockage of DNA synthesis is eliminated by photoreversal in Escherichia coli strain WP2. At the higher critical dose just below that which results in non-dark repairable inactivation of DNA synthesis, little photoreversal of dark repairable blockage is observed. Damage which is not dark repairable induced about this dose is photoreversible. The non-photoreversible, dark repairable damage which occurs with doses below the critical level appears to be responsible for the requirement for RNA and protein formation in repair of the uv-damaged DNA synthetic system, as indicated by the blockage of DNA synthesis after photoreversal treatment by the antibiotic, chloramphenicol. Neither dark repairable damage nor non-dark repairable damage is photoreversed in a non-photoreversible strain of E. coli. Induction of lethality is correlated with induction of photoreversible, non-dark repairable damage to DNA synthesis. Lethality is photoreversible in strain WP2 but not with the non-photoreversible strain. The chloramphenicol-sensitive mutation process appears to require the induction both of photoreversible, dark repairable damage, and of non-photoreversible, dark repairable damage. Induced mutation (tryptophan requirement reversion) in strain WP2 is photoreversible over the dose range investigated. The induction of non-photoreversible damage to DNA synthesis can be correlated with the nonlinearity of the uv-induced mutation curve obtained with lower uv doses. (auth)

**42813** PEROXIDES AS A FACTOR OF ATHEROSCLEROSIS. Iwakami, Minoru (Nagoya Univ., Japan). Nagoya J. Med. Sci., 28: 50-66(Dec. 1965).

Tests were carried out to determine the effect of x radiation, which induces the auto-oxidation of lipids, and of vitamin E, which prevents the peroxidation of lipids, on atherosclerotic changes in the human aorta by testing aortas of rabbits and rats. The determinations of peroxides were carried out by the ammonium thiocyanate method. A correlation existed between the extent of the atherosclerotic changes and the content of lipid peroxides. The aortas with no atherosclerotic changes contained only small amount of peroxides. Peroxides of the rabbit aorta were determined by the method of TBA. Vitamin E injection prevented lipid peroxidation in the aortas and livers. Furthermore, Vitamin E suppressed the atherosclerotic changes. Peroxides were produced by x irradiation in the aortic wall and liver of the rabbit. Whole body x irradiation promoted the progress of atherosclerotic changes in cholesterol fed rabbit, and produced atheroma-like plaque in the thoracic aorta of the rabbit. The respiration of the aorta of rat was decreased by peroxides added in the diet. However, the respiration of liver was not influenced. The activity of cytochrome oxidase was more inhibited than that of succinic dehydrogenase. In vitro effect of peroxides on the respiration of the aorta of rats was also observed. (auth)

**42814** BREAKDOWN OF RIBONUCLEIC ACID IN ESCHERICHIA COLI B AFTER X IRRADIATION. **Pecevsky, I.; Miletic, B. (Inst. Ruder Boskovic, Zagreb). Nature, 210: 325-6(Apr. 16, 1966).**

Cultures of E. coli B were x-irradiated (16,000) R to determine whether the radiation damage of DNA is accompanied by an alteration of the synthesis of RNA. The breakdown of RNA was found to depend on the dose of irradiation, but at all doses, the breakdown began 30 min after irradiation and was linear during the following 120 min. Results further showed that RNA labeled immediately after irradiation decomposed at the same rate as that labeled 40 min before irradiation. Preliminary analyses of cell-free extracts on sucrose density gradients showed that ribosomal RNA represents a considerable fraction of the degraded RNA. (H.G.D.)

**42815** RADIATION-INDUCED CALCIUM RELEASE AND ITS RELATION TO POST-IRRADIATION TEXTURAL CHANGES IN FRUITS AND VEGETABLES. **Shah, J. (Univ. of California, Davis). Nature, 211: 776-7(Aug. 13, 1966).**

The release of Ca from Avena coleoptiles and from peaches irradiated at ambient temperatures over a dose range of 50 to 1000 krads is described. Compared with the controls, the irradiated tissues lost electrolyte very rapidly, as was shown by increases in conductivity. The amount of Ca retained in the tissues was proportional to dose up to 600 krad, after which there was about 80% loss of Ca. Irradiation at 0°C did not decrease the Ca release over the dose range investigated. It is concluded that the release of Ca plays an important role in radioinduced softening of fruit and other plant tissue. (H.G.D.)

**42816** COMPARISON OF THE EFFECT OF ALPHA AND GAMMA RADIATION ON AN ENZYME. **Kopp, P. M.; Read, J. F.; Charlesby, A. (Royal Military Coll. of Science, Swindon, Eng.). Nature, 211: 959-60(Aug. 27, 1966).**

Irradiations of yeast alcohol dehydrogenase were carried out with 0.1 ml of 0.1 per cent solution in special glass Melinex cells at room temperature in the presence of air with doses between 0.025 and 0.6 M rads both with alpha and gamma radiation. The residual activity of the irradiated alcohol dehydrogenase was determined spectrophotometrically. The results indicated an exponential decrease in activity. Gamma radiation was about four times as effective as alpha radiation in inactivating alcohol dehydrogenase in aqueous solution. Average inactivation energy was four times greater for alpha radiation than for gamma. Preliminary protection experiments have indicated that thiourea, cysteamine, cystamine, cystine, and cysteine at low concentrations protect the enzyme against both gamma and alpha radiation. (H.L.W.)

**42817** COMPARISON OF BIOLOGICAL EFFECTS OF RADIATION OF DIFFERENT ENERGIES. REPORT 1. COMPARISON OF BIOLOGICAL EFFECTIVENESS OF 15-Mev ELECTRON BEAMS AND 200 kv X RAYS ON THE EHRLICH ASCITES TUMOR CELLS. **Ochi, Hironobu (Osaka City Univ.). Osaka Shiritsu Daigaku Igaku Zasshi, 14: 565-78(Dec. 1965). (In Japanese).**

The effect of radiation on a dry mass of Ehrlich ascites tumor cells was studied using an AO Baker interference microscope. While irradiation with a dose of 50–100 R in vivo caused no marked effects on the dry mass, irradiation with doses of 300, 500, or 1000 R caused a considerable increase in the dry mass. The increase started 6–12 hours after irradiation, showing further increase in 48 hours. The increase in dry mass observed 24 hours after irradiation was directly proportional to the radiation dose. Fifteen Mev Betatron electron beams and 200 Kv x rays produced no qualitatively different effect, but 15 Mev Betatron electron beams produced less marked increase in the dry mass than 200 kv x rays. The increase in the dry mass was studied in reference to mitotic activity. The dry mass increased during a mitotic delay maintaining a high level for 48 hours. Correlations between the dry mass of tumor cells and mitotic activity are discussed. (auth)

**42818** INACTIVATION OF SOLUTIONS TRANSFORMING DEOXYRIBONUCLEIC ACID WITH THE AID OF $\gamma$ RADIATION IN THE PRESENCE OF INHIBITING SUBSTANCES. **Pakula, Roman; Walczak, Wlodzimierz; Shugar, Dawid (State Division of Hygiene, Warsaw). Postepy Mikrobiol., 1: 129-38(1962). (In Polish).**

Two preparations of tDNA were used in which the ratios of maximum to minimum uv absorption were 1.80 and more than 2.05. The preparation with a ratio of 1.80 was much more resistant to the effects of gamma radiation. The inactivation curves were determined for different rates of gamma exposure, showing that the exposure rate had no effect on the inactivation vs dosage curve with the absence of inhibitors. The inactivation curves were determined as a function of inhibiting agent, of inhibitor concentration, gamma dose rate, and of the influence of air, oxygen, and nitrogen atmospheres. Two of the three inhibitor activities were found to be the most insensitive in oxygen. (TTT)

**42819** INACTIVATION OF ALKALINE PHOSPHATASE SOLUTIONS UNDER THE INFLUENCE OF $^{60}$Co $\gamma$ IRRADIATION AND INVESTIGATION OF SOME PROPERTIES OF IRRADIATED PHOSPHATASE. **Nikolskaya, E. B. Radiobiologiya, 6: 23-6(1966). (In Russian).**

Aqueous solutions of alkaline phosphatase of various concentrations were exposed to $^{60}$Co $\gamma$ radiation at the rate of 600 R/hr. The relative activity of the irradiated enzyme was determined as the ratio of the initial rates of hydrolysis of sodium phenylphosphate at pH 8.8 to 10.7 when compared with nonirradiated solutions at temperatures from 10 to 60°. The influence of the time of preparation of the enzyme solutions on radiosensitivity and the time of storage of irradiated solutions on oxidizing activity were also studied. The results confirmed the hypothesis that the decrease in activity of irradiated phosphate is explained by the irreversible inactivation of the enzyme under the experimental conditions used. (C.H.)

**42820** RESPIRATION OF SALMO SALAR L. SPAWN IN RADIOACTIVELY CONTAMINATED WATERS. **Neustroev, G. V.; Podymakhin, V. N. Radiobiologiya, 6: 115-16(1966). (In Russian).**

Salmon roe (Salmo salar) were maintained during development in aquaria under diffuse lighting at a water temperature of 1.5 to 2.5° and under similar conditions with $^{137}$Cs at concentrations of $1.10^{-6}$ C/l added to the water. Respiration of the roe was measured during development and the oxygen consumption was calculated per gram and per egg. Results showed that oxygen consumption by roe in the aquarium with $^{137}$Cs increased gradually but always remained higher than the control while oxygen consumption in control roe increased constantly. After hatching the control larvae consumed 50% more oxygen than did roe while larvae from the aquarium with $^{137}$Cs consumed twice as much oxygen as on the day before hatching. It was concluded that the respiration intensity increased in irradiated roe and larvae. (C.H.)

**42821** CURRENT TRENDS IN RADIOBIOLOGY. **Inch, W. R.; McCredie, J. A. (Ontario Cancer Treatment and Research Foundation, London. Univ. of Western Ontario, London). pp 115-33 of Science in Alaska. Dahlgren, George (ed.). Alaska Division of American Asso-**

ciation for the Advancement of Science, 1965. (CONF-640819-1).

The radiochemical processes involved in the absorption and degradation of an x- or $\gamma$-ray photon are discussed. Cell death results from lesions caused by the production of ions and oxidizing radicals. In the presence of oxygen this damage is nearly three times greater. Gamma and x rays have a low linear energy transfer (LET) and produce their effect through oxidizing radicals. High LET radiations such as alpha particles act primarily through ionization. The DNA molecule is the important target molecule in cell death, and each damaging agent seems to act at a particular molecular site. The site of action for ionizing radiation, alkylating agents such as nitrogen mustard, and ultraviolet radiation are illustrated and mechanisms of action suggested. (C.O.)

**42822** EARLY REACTIONS OF PERIPHERAL BLOOD AND BONE MARROW TO LETHAL WHOLE-BODY IRRADIATION. **Loehr, Eberhard** (Univ., Marburg, Ger.). Strahlentherapie, 130: 361-9(July 1966). (In German).

Bone marrow changes in acute radiation syndrome are described. Hemorrhage, swelling of marrow, and the presence of mononuclear cells are observed after whole-body irradiation. Radiation causes changes in cell regulation and content of glycolytic enzymes and nucleotide concentration. Methods of studying enzymes of bone marrow after whole-body radiation are given. Comparative studies on bone marrow cells after in vitro irradiation are described. Effects of ionizing radiation on glutathione content of bone marrow are described. The effects of whole-body irradiation on enzyme activity and nucleotide concentration in bone marrow are discussed. Metabolites of glycolysis in bone marrow before and after whole-body radiation are listed. These metabolites are glucose-6-phosphate, fructose-6-phosphate, fructose-1,6-diphosphate, dioxyacetonephosphate, lactic acid, and pyruvate. The content of oxidized and reduced glutathione of bone marrow after in vivo and in vitro radiation is reduced. (H.L.W.)

**42823** EFFECTS OF UV RADIATION ON THE SERUM PROPERDIN LEVEL IN VITRO. **Pfordte, Klaus** (Univ., Halle, Ger.). Strahlentherapie, 130: 459-63(July 1966). (In German).

Serum properdin was denatured in vitro by UV-light. The properdin titer of human serum was decreased significantly by 36% after irradiation with the total spectrum of a high pressure Hg-lamp (SR 300, Hanau) for 2 hours using a distance of 30 cm (2 ml of serum in quartz cuvettes; layer thickness 0.5 cm). The titer of bovine serum treated under the same conditions was decreased by 19.5% after 40 min. At the same time, while the total protein level was unaltered, statistically proven changes within the single fractions of the serum protein were observed. A possible properdin synthesis, as discussed in the literature, from inactive serum proteins by means of photochemical structural changes, did not occur in these experiments. Properdin was relatively stable in regard to heat (up to 37°). At 37°C the properdin titer of human serum decreased by 1.5% after 2 hours; the properdin titer of rat serum decreased by 9.5% (not certain) of the initial value. (tr-auth)

**42824** BEHAVIOR OF KIDNEY-, LIVER-, AND SERUM ESTERASE OF RATS FOLLOWING WHOLE- AND PARTIAL-BODY IRRADIATION AND THE EFFECT OF THE SERUM OF IRRADIATED ANIMALS ON THE NORMAL KIDNEY- AND LIVER-ESTERASE. **Kikuchi, Yozo; Hornung, Guenter; Braun, Heribert** (Univ., Wuerzburg, Ger.). Strahlentherapie, 130: 567-78(Aug. 1966). (In German).

Esterase was determined in liver, kidney, and serum of white Sprague-Dawley rats after whole-body irradiation with 600 R. Two days after whole-body irradiation the same decrease in esterase was found in the renal cortex in kidney marrow, and in the total kidney. The serum esterase was increased. A distinct decrease in activity of the liver esterase was found 4 days after the irradiation. The esterase activity in the organs mentioned was the same regardless whether whole or partial body irradiation was given. After fractionating the serum with Sephadex followed by an incubation of the separated fractions with liver or kidney tissue, an inhibition of the kidney esterase activity by the globulin fractions rich in cholesterol was found after whole-body irradiation. This could not be observed in case of liver esterase. The albumin fractions also inhibited the esterase in the kidney after x-irradiation, but there were no changes in the liver homogenate. (auth)

**42825** MECHANISM OF IMPAIRMENT OF OXIDATIVE PHOSPHORYLATION IN TISSUES OF IRRADIATED ANIMALS. **Kakushkina, M. L.; Kudryashov, Yu. B.; Sivkova, V. G.; Skulachev, V. P.** (Moscow State Univ.). Vop. Med. Khim., 12: 147-50(Mar.-Apr. 1966). (In Russian).

Ability of an acetone fraction of lipids from liver to inhibit the rate of oxidative phosphorylation and to decrease the P/O ratio in isolated mitochondria was found to be increased after acute radiation injury of rabbits. The oxidative phosphorylation of mitochondria treated in this way could be activated by serum albumin. (auth)

**42826** RADIATION INDUCED CHANGES IN POLYAMINO ACIDS. **Southern, E. M.; Rhodes, D. N.** (Agricultural Research Council, Cambridge, Eng.). 13p. (CONF-650902-34). ORAU. Gmelin, AED-CONF-65-235-71.

From American Chemical Society, 150th National Meeting, Atlantic City.

Radioinduced changes in properties of the synthetic polyamino acids, poly-L-glutamic acid, poly-L-lysine, and poly-D, L-alanine, are discussed. Results are given on the inversion to D-glutamic acid in poly-L-glutamic acid after irradiation with $^{60}$Co gamma rays, on radiolysis of peptide bonds, and on effects of pH on viscosity changes in irradiated poly-L-glutamic acid and poly-L-lysine. (W.E.B.)

## Radiation Effects on Tissues

*Refer also to abstracts 42772, 42776, 42796, and 42822.*

**42827** (ABCC-58-59) ANNUAL REPORT, JULY 1, 1958-JUNE 30, 1959. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Contract AT-49-1-GEN-72. 114p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

The status during 1958 and 1959 of research projects on the effects of radiation from the 1945 atomic bomb explosions on the populations of Hiroshima and Nagasaki is reviewed. Major findings of the medical surveillance and ancillary programs are summarized. (C.H.)

**42828** (ABCC-59-60) ANNUAL REPORT, JULY 1, 1959-JUNE 30, 1960. (Atomic Bomb Casualty Commission, Hiroshima (Japan)). Contract AT-49-1-GEN-72. 146p. Dep. mn. CFSTI $4.00 cy, $1.00 mn.

The status during 1959 and 1960 of 81 research projects on the effects of radiation from the 1945 atomic bomb explosions on the populations of Hiroshima and Nagasaki is reviewed. Major findings of each study are summarized. Long-range studies include the clinical evaluation of exposed persons and their children for radiation effects on life span, incidence of leukemia and other neoplasms, effects on development of children exposed in utero, effects on hematological and opthalmological conditions, genetic effects, effects on aging, effects on thyroid function in adolescents exposed while babies, effects on incidence of tuberculosis, diabetes, cardiovascular diseases, and other pathological conditions, post-mortem pathological findings on exposed individuals, and absenteeism among industrial workers. A list is included of reports that cover these and ancillary studies. (C.H.)

**42829** (AD-635167) ESTIMATION OF PARAMETERS IN MULTIVARIATE EXPERIMENTAL DESIGN AND A HYPOTHETICAL APPLICATION TO ESTIMATING FRACTIONAL DOSE RECOVERY EFFECTS. **Greenwood, J. A.** (Armed Forces Radiobiology Research Inst., Bethesda, Md.). Feb. 1966. 22p. (AFRRI-TN-66-2). CFSTI $1.00 cy, $0.50 mn.

A statistical technique for the estimation of recovery of animals from radiation injury is explained, derived, and illustrated. It is believed that a study of the values of the terms of the assumed mathematical model (or the graphs therefrom) would be of great informational help to the scientist in interpreting his results. Analysis of variance, components of variance analysis, and the estimation technique described herein applied to a properly designed experiment will go far toward extracting all the relevant information from a sample. Estimation formulas for the terms of the assumed mathematical model are derived for two of the most used statistical experimental designs, the factorial and the orthogonal squares. The method is illustrated on a three-variable, hypothetical dose recovery experiment. It is pointed out that the method gives one a handle on measuring quantitatively the separate and joint contributions to the observed effect, of variables otherwise hopelessly correlated and overlapping. (auth)

**42830** (AD-635598) STUDIES ON THE RADIOSENSITIVE PHASE OF THE PRIMARY ANTIBODY RESPONSE. II. THE EFFECT OF MACROPHAGES FROM IRRADIATED DONORS ON ABILITY TO TRANSFER ANTIBODY FORMATION. Pribnow, J. F.; Silverman, M. S. (Naval Radiological Defense Lab., San Francisco, Calif.). June 13, 1966. 17p. (USNRDL-TR-1029). CFSTI $1.00 cy, $0.50 mn.

Peritoneal exudate cells were harvested from rabbits which had received 450, 550, or 750 R x irradiation twenty-four hours previously. After incubation with bovine gamma globulin these cells were injected into normal rabbits. When donors had received 750 R, no antibody response was elicited in the recipients. The response to sensitized irradiated macrophages which had received 450 or 550 R was varied. In no case did the degree of antibody response appear to depend on the number of sensitized cells injected. Irradiated recipients receiving sensitized irradiated macrophages (550 R) together with lymph node cells from normal rabbits were unable to form antibody. The implications of these findings in relation to the radiosensitive phase of the antibody response are discussed. (auth)

**42831** (AD-635600) COLONY-FORMING UNIT REPOPULATION AND SPLIT-DOSE RADIOSENSITIVITY IN ENDOTOXIN TREATED AND CONTROL LAF$_1$ MICE. Hanks, G. E.; Ainsworth, E. J. (Naval Radiological Defense Lab., San Francisco, Calif.). May 23, 1966. 18p. (USNRDL-TR-1024). CFSTI $1.00 cy, $0.50 mn.

Radiosensitivity of an animal, in terms of survival or death following midlethal exposure, is thought to be related to the surviving number of hematopoietic stem cells. After a sublethal exposure to radiation an animal's sensitivity to a subsequent exposure (LD$_{50}$) might also be expected to be related to the number of stem cells which are present at any given time. The relationship between split-dose LD$_{50}$ and changes in the numbers of nucleated cells in the femur and the femoral content of colony-forming units (CFU's) was studied in x irradiated rats. These CFU's are proliferative cells in the marrow which when transplanted have the capacity to form nodules in the spleens of supralethally irradiated recipient mice. Many stem cell-like attributes have been conferred to CFU's, and the CFU is frequently referred to as a hematopoietic stem cell. In the present experiments, changes in marrow cellularity and CFU content were studied for three weeks after exposure to 450 R, and preliminary LD$_{50}$'s were determined at 5 or 14 days. One group of animals was given bacterial endotoxin before the 450 R exposure. During the first week after 450 R, the endotoxin-treated animals showed an accelerated recovery in terms of numbers of nucleated marrow cells and CFU's, and at day 5 the femoral CFU content of the endotoxin-treated animals was ten times as great as that of the controls. However, at this time the LD$_{50}$ of the endotoxin-treated animals was only 50 R higher than the controls. At 14 days, the femoral CFU content of the control animals was approximately four-fold greater than that of the endotoxin-treated group, but the LD$_{50}$'s of the two groups were quite similar. Therefore, in these experiments with endotoxin-treated and control animals, the femoral CFU content and split-dose radiosensitivity were found to vary independently. (auth)

**42832** (ANL-7136) BIOLOGICAL AND MEDICAL RESEARCH DIVISION ANNUAL REPORT, 1965. (Argonne National Lab., Ill.). Dec. 1965. Contract W-31-109-eng-38. 342p. Dep. mn. CFSTI $7.00 cy, $1.75 mn.

Separate abstracts were prepared for 21 sections of this report. A list is included of 137 publications during the period covered by this report. (C.H.)

*For abstracts of individual sections see: 42698–42703, 42737, 42738, 42833–42842, 42997, 43512, and 43668.*

**42833** (ANL-7136, pp 16-46) SOMATIC EFFECTS. (Argonne National Lab., Ill.).

Preliminary results are reported from a study of the relation of genetic factors to radiation resistance, longevity, brain structure, and behavior in mice. Data are presented on the development of criteria for learning initial and altered maze patterns and brain weight studies. Preliminary data are presented from a comparison of the lethal effects of prenatal and postnatal daily x irradiation of mice. Data are presented from studies on $\gamma$ radiation effects on reproductive performance and the induction of congenital malformations in mice. Colonies of about 30 species of rodents were established for use in comparative studies of the anatomy and physiology of radiosensitivity and aging. Data are included from measurements of the $\gamma$ radiosensitivity of 5 species of wild rodents and the effects of a single acute exposure to fission neutrons on running activity in the deer mouse (Peromyscus leucopus). Results are summarized from studies of the effects of lifetime periodic $\gamma$ exposure on the pathology and survival of guinea pigs; the effects of $\gamma$ and x radiation on the pathology and survival of chickens; the acute $\gamma$ radiation response of experimental mice; the use of the spleen-colony method to study recovery mechanisms in mice exposed to 800 R $\gamma$ radiation or fractionated doses of fission neutrons; and the incidence of mammary neoplasms in rats following single exposures to fission neutrons. The Janus program for investigating the late effects of continued exposure of mice to low-level fast neutrons and $\gamma$ radiation is discussed. (C.H.)

**42834** (ANL-7136, pp 46-63) CELLULAR EFFECTS. (Argonne National Lab., Ill.).

Progress is reported in studies of the effects of various doses of $\gamma$ radiation on epithelial cells of the mouse intestine; the kinetics of cell proliferation in intestinal and gall bladder epithelium of mice; the effects of x radiation on cultured mouse neoplastic mast cells; the effects of x radiation on the tensile strength of rat vibrissae; the development of most cells in adult and fetal rats; and the effects of various doses of $\gamma$ or x radiation on the survival of hibernating ground squirrels. (C.H.)

**42835** (ANL-7136, pp 63-80) PHYSIOLOGICAL EFFECTS. (Argonne National Lab., Ill.).

Progress is reported in studies of the physiological effects of $\gamma$ and x radiation on ground squirrels, guinea pigs, rabbits, and rats. Data are included on the effects of $\gamma$ and x radiation and temperature on the survival of the hibernating ground squirrel (Citellus tridecemlineatus); the effects of a nematode invasion on the central nervous system of ground squirrels; auxin formation by preparations of regenerating rat liver; the effects of x radiation on the metabolism of 5-$^{125}$I-iododeoxyuridine in rats; the incidence of amyloid in the ileum of mice and the diagnosis of amyloidosis in mice; studies on intestinal obstruction in rats; the effects of x radiation and nucleic acid analogs on hemolysin production in rabbits; x radiation effects on antibody synthesis in rats; delayed hypersensitivity to Trichinella spiralis infections in guinea pigs; the effects of x radiation on antigen localization and the uptake of $^3$H-thymidine in antigen-injected rats; the effects of actinomycin D an antibody synthesis in cultured rat tissues; and the measurement of the intensity of immune response in rabbits and rats. (C.H.)

**42836** (ANL–7136, pp 109-23) TOXICITY AND METABOLISM OF RADIONUCLIDES. (Argonne National Lab., Ill.).

Data are summarized from a systematic long-term study on the effects of selected fission products, administered singly or as well-defined mixture, on dogs. Data are included on the metabolism and toxicity of $^{137}$Cs and $^{144}$Ce given intravenously in single doses to dogs of different ages. The effects of injected $^{137}$Cs were compared to those produced by whole-body irradiation using a $^{60}$Co $\gamma$ source. The effects of radiation on the life span, gross pathology, and microscopic findings were measured. Studies of growth patterns in beagles and exchange skin graft histocompatibility in inbred and unrelated dogs are also reported. A computer program was developed for determining inbreeding coefficients and relations in a dog colony in which inbred lines were mated with a larger outbred population. The program can be used to evaluate any group of individuals and determine the amount of inbreeding involved for each individual in the group. (C.H.)

**42837** (ANL–7136, pp 124-40) MAMMALIAN GENETICS. (Argonne National Lab., Ill.).

Preliminary data are presented from a study of induced mutation rates for sex-linked recessive lethals and visible autosomal genes in mouse populations resulting from the mating of females carrying a sex-linked mutation, tortoise (T$_0$), and irradiated and normal males to produce F$_1$ T$_0$ females which were outcrossed to produce an F$_2$ generation. Data on the lifetime reproductive performance of tortoise and normal hybrid female mice indicated that the sex-linked recessive mutant tortoise reduces the mean litter size and body weight, increases pre- and early postnatal losses, and effects skeletal changes. The morphology and incidence of the tapetum in canine eyes was investigated. Since the canine eye that lacks the tapetum is quite similar to the human eye, it may provide a superior test system for radioinduced eye lesions. The mode of inheritance of the atapetal characteristic was investigated in a dog colony and preliminary results are reported. A search for acatalasemic and hypocatalasemic mouse mutants resulted in the establishment of five true genetic aberrant lines with variations of blood catalase activity of homozygotes ranging from 1 to 75% of normal, with one mutant line having characteristics that resemble the human acatalasemic individual. Studies of erythrocyte catalase activity in these mutants indicated molecular species distinguishable from normal blood catalase but differing among the mutants. The possible role of catalase in the peroxidative catabolism of alcohols was investigated in these acatalasemic and hypocatalasemic mutant mice after the injection of methanol or ethanol, with or without the injection of the catalase inhibitor aminotriozole. No significant metabolic differences were observed between normal and mutant mice or their tissues. Progress is reported in studies on the structure, biological functions, and genetic control of myeloma proteins, and Bence-Jones proteins. Autoradiograms were examined for evidence of the inhibition of $^{3}$H-thymidine incorporation in cultured swine kidney cells by far-red light. The enhancement of the frequency of x-ray induced chromosome aberrations by exposure to far-red light was observed in cultured swine kidney cells by cytological examination of cells 4.5 hr after x irradiation. The effects of cell cycle and sampling time on results are discussed. Progress is reported in the development of computer techniques for the characterization and pairing of chromosomes. The system requires that the chromosomes at metaphase be photographed on 35-mm film which is scanned by the digitally controlled cathode-ray tube scanner CHLOE, with the resulting data analyzed by an IBM 704 computer program. The reconstruction of the chromosome figures from the digital data is done by the computer GEORGE, which is equipped with a cathode-ray tube output device. An analysis of computer pairing versus human-manual pairing of chromosomes of Mastomys natalensis, it was found that the computer was more efficient than man in selecting the correct chromosome with its homologous pair. (C.H.)

**42838** (ANL–7136, pp 140-54) MICROBIAL GENETICS. (Argonne National Lab., Ill.).

The kinetics of mutation to resistance to bacteriophage T5 were measured in continuous chemostat cultures of a strain of Escherichia coli in which repair ability is reduced or absent. The absence of a common segregational division in newly-formed mutants suggests that a single master strand of DNA specifies the coding sequence of both newly forming strands of DNA, which is not explained by the Watson-Crick model of replication. Analysis of data obtained from microcolonies of Escherichia coli, which were photographed for periods of 3 to 5 generations, provide evidence for the inheritance of factors that affect cell interdivision times in progeny lines and also evidence that interdivision times are determined by two major and competing factors. Application of these findings in mathematical models of the statistics of the cell division process and the growth of cell populations are discussed. A model is presented for the replication of DNA. A study of photodynamic mutation in continuous cultures of E. coli treated with several acridine dyes of varying complexity indicate a direct action on DNA as the basis of photodynamic mutagenesis. The oxygen effect in the protection by acridine orange against uv induced inactivation and mutagenesis was investigated in two strains of Escherichia coli that differed in tryptophan requirements. Possible reaction mechanisms involved in the protective effect of acridine orange are discussed. Mechanisms involved in caffeine-induced mutagenesis in Escherichia coli were studied using $^{14}$C-caffeine to determine the sites of caffeine binding in E. coli. Preliminary results are included from a study of the relation of DNA synthesis to genetic recombination in E. coli. (C.H.)

**42839** (ANL–7136, pp 154-61) DEVELOPMENTAL BIOLOGY. (Argonne National Lab., Ill.).

Crafting experiments on amphibians showed that primordial germ cells are set aside from the presumptive somatic cells very early in embryonic development. Studies on Rana pipiens fertilized eggs exposed to 7,700 to 15,000 ergs/mm$^2$ of uv radiation during various developmental stages indicated that a cytoplasmic component, probably nucleic acid, which is present in the vegetal pole even before the first cleavage division, acts to control the later formation of a single cell type or primordial germ cells. Tritiated leucine was injected into Rana pipiens eggs or early embryos and the rate of protein synthesis was measured. Data are included from a preliminary study of lens differentiation in early chick embryos. A molecular model for the circadian clock is presented that is based on the premise that messenger RNA produced at one particular time of the daily cycle is different from messenger RNA synthesized at other times. (C.H.)

**42840** (ANL–7136, pp 164-90) MECHANISMS OF CARCINOGENESIS AND NEOPLASTIC GROWTH. (Argonne National Lab., Ill.).

Progress is reported in studies on the mechanisms of carcinogenesis in mice exposed to external $\beta$ radiation as a function of dose, dose rate, genetic constitution, and combined treatment with initiating and promoting agents. The preparation of exposure chambers from cylindrical containers lined with polyurethane sheets containing microspheres of $^{90}$Sr-$^{90}$Y or $^{204}$Tl is described, and preliminary results of irradiation studies are reported. A pilot experiment to study sarcoma production by intraperitoneally implanted plastic films is reported in progress. Experiments in rats using millipore plastic implants in conjunction with 400-R local x irradiation showed that irradiation 4 mo after implantation had no effect on sarcoma incidence while irradiation 8 mo after implantation reduced sarcoma incidence by at least one half that of controls. Implanted $^{90}$Sr-$^{90}$Y sources in thin plastic film did not give rise to tumors after 2-mo exposure in the order of 1000 rads/day. Two years after the subcutaneous injection of particulate $^{239}$Pu to rats, about 35% of the injected amount remained in the area of the injection. Bone tumors appeared in some animals after 360 days when skeletal burden was 2.6μg or above. Injection site tumors also appeared about 360 days after injection. Progress is reported on studies of the relation of DNA synthesis, as measured by $^3$H-thymidine uptake, and x-ray induced carcinogenesis in rat mammary epithelium; the cocarcinogenic effects of 2,7-diacetylaminofluorene and whole-body fission neutron irradiation on rats; the dynamics of relative growth, using data on the growth of the parts of the human embryo, the chick embryo, and young post-natal rats; and the effects of two hydrogen peroxide-inducing agents, the enzyme glucose oxidase and 1-methyl-2-*p*-(isoproplylcarbamoyl)-benzyl hydrazine hydrochloride, on the weight of ascites tumor-bearing mice. Progress is reported on investigations of neutron capture and conversion therapy of cancers. Emphasis is placed on the examination of parameters of systems involving intermediate range (60 kev) neutrons and $^7$Li or $^{235}$U as the target material. Both arsenazo mouse serum albumin and cobalt phthalocyanine tetrasulfonate anion were found to localize well in spontaneous somatic murine tumors, and the possibility of using these compounds as carriers for the localization of $^{235}$U analogs and other target materials for effective neutron-capture therapy is discussed. Boronic acids for possible use in neutron-capture therapy ($^{10}$B) were also investigated and data are included on the interactions of benzeneboronic acids with tissue. The effect of starvation and the effects of rapidly growing neoplastic mast cell tumors on the life span, cell proliferation, and cytological and histological changes in tissues were compared in mice given tritiated thymidine and colcemide 2 hrs before killing. (C.H.)

**42841** (ANL-7136, pp 266-89) BIOPHYSICS. (Argonne National Lab., Ill.).

Progress is reported on a number of biophysical studies. Data are presented from studies on the effects of age in the generation cycle on the survival of x irradiated hamster cells in culture; the survival of hamster cells after exposure to monoenergetic neutrons; the repair of radiation injuries in x-irradiated hamster cells; size changes in hamster cells during the generation cycle; cytological studies of chromosomes in x ray-induced giant cells in hamster tissue cultures; the properties of nitrogen heterocyclics; the effects of heat on globular proteins; the binding of acridine to DNA; the stability of nucleic acids; and the use of mouse testis weight as an indicator of effects of x radiation. The design of a simple, low-cost control for slowly raising device electrical power level to a fixed value, holding, and return to zero is described. (C.H.)

**42842** (ANL-7136, pp 290-301) PLANT RADIOBIOLOGY. (Argonne National Lab., Ill.).

Progress is reported on studies on the effects of $\gamma$ and x radiation on plant physiology and related studies. Data are presented from studies on the effects of x radiation and light intensity on the formation of flower primordia in Xanthium; the effects of $\gamma$ irradiation of leaves on root initiation in Coleus; the effects of light on the metabolic responses of squash seedlings; and the action spectrum for photolysis of *Myxococcus xanthus*. (C.H.)

**42843** (BNL-10358) FACTORS INFLUENCING VARIATION IN RBE IN IRRADIATION OF MAIZE SEEDS. Smith, Harold H.; Combatti, Nicholas C. (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract AT(30-2)-Gen-16. 5p. (CONF-660710-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Cooperative International Neutron Seed Irradiation Program Meeting, Vienna.

Dormant maize seeds, heterozygous for the yellow-green alleles, $\underline{Yg_2/yg_2}$, were exposed to 250-kvp x rays and to reactor-generated fast neutrons in order to determine RBE values on the basis of seven different criteria: frequency of $\underline{yg_2}$ sectors per rad, seed set, pollen fertility, plant height, seedling survival, seedling emergence, and plant height reversal effect. Semi-log survival curves were plotted from the data. Results showed that the RBE of reactor-generated fast neutrons compared to 250-kvp x rays is markedly influenced by the criteria used for comparison and the physiological condition of the seeds. (C.H.)

**42844** (BNL-10385) BONE MARROW STEM CELL SURVIVAL IN THE NONUNIFORMLY EXPOSED MAMMAL. Bond, V. P.; Robinson, C. V. (Brookhaven National Lab., Upton, N. Y.). July 6, 1966. Contract AT(30-2)-Gen-16. 11p. (CONF-660543-2). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Conference on Effects of Various Types of Ionizing Radiations from Different Sources on the Hematopoietic Tissue, Vienna.

A model of the irradiated hematopoietic system was developed for use in the comparison of the effectiveness of nonuniform vs uniform irradiations in causing hematological death in mammals. The essential features of this model are that different parts of the hematopoietic system have numbers of stem cells which are proportioned to the amounts of active marrow in those parts as measured by $^{59}$Fe uptake, that stem cells in the different parts are subject to the same dose-survival relation, and that survival of the animal depends on survival of a critical fraction of the total number of stem cells independent of their distribution among the parts of the total marrow mass. In order to apply this model one needs to know the relative $^{59}$Fe uptakes of the different parts of the hematopoietic system, the doses delivered to those parts by each of the exposures to be compared, and the dose-survival curve applicable to the stem cells. From these one can calculate the fraction of stem cells surviving each exposure. The applicability of the model was investigated using data obtained entirely from the literature. Additional data, particularly on bone marrow distribution, were obtained and are included. Data on bilateral (essentially uniform) *versus* unilateral and nonuniform rotational exposures in mammals were examined with respect to the surviving fraction of stem cells at the $LD_{50/30}$ day dose level. Although an adequate test is not presently possible for lack of a full set of data in any one species, a partial test indicates compatibility with data for dogs and rats. The data indicate that survival of the mammal after exposure to lethal doses of x radiation is determined by the surviving fraction of total marrow stem cells, independent of location in the body. (C.H.)

**42845** (CONF-660543-1) RATES OF BLOOD FORMATION AND RATES OF BLOOD CELL DEPLETION AND RECOVERY AFTER IRRADIATION. Patt, Harvey M. (California Univ., San Francisco. Lab. of Radiobiology). [1966]. Contract AT(11-1)-Gen-10. 14p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Conference on Effects of Various Types of Ionizing Radiations from Different Sources on the Hematopoietic Tissue, Vienna.

Basic parameters of normal hematopoiesis are reviewed. The effects of radiation on the production of hemic cells are discussed and data from tracer studies of metabolism and maturation and release of hemic cells from bone marrow are reviewed. It is pointed out that in analyzing the response of hematopoietic tissues to radiation the sensitivity of individual cells must be distinguished from that of the system as a whole, and that hemic cells vary in radiosensitivity at different phases of the cell cycle, and that some forms of radiation damage become manifest only after the cell resumes mitosis. Recovery of cells may also depend on the proliferation rate and evidence indicates differences in the recovery rate among the various proliferating blood elements that is reflected in a differential radiosensitivity. While impairment in cell production is the focal point of radioinduced hemic cell depletion other aspects of the cell renewal system, some of which may be the result of derangements outside the sytem, may also be involved. It is concluded that it is the depth and duration of the radioinduced block of hemic cell production that is important rather than specific mechanisms that bring it about. The hematopoietic system can recover from radiation injury only if some minimal number of progenitor cells have retained their capacity to give rise to an unlimited amount of progeny. (26 references.) (C.H.)

**42846** (IAEA-2466-13) STUDIES ON THE INDUCTION OF NEW GENETIC VARIABILITY FOR QUANTITATIVE TRAITS BY SEED IRRADIATION AND ON ITS USE FOR WHEAT IMPROVEMENT. Scossiroli, R. E.; Palen-

zona, D. L.; Scossiroli-Pellegrini, S. (Bologna Univ. (Italy). Istituto di Genetica. Pavia Univ., Rieti (Italy). Centro Appenninico di Genetica. Pavia Univ. (Italy). Istituto di Genetica). [1964]. Contract AT(30-1)-2466. 40p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The feasibility of using radioinduced mutations in plant breeding programs is discussed. Results are summarized from studies on the mutagenic effects of doses of 2000, 4000, or 8000 R x radiation on seeds of two wheat varieties, T. durum (tetraploid) and T. aesitivum (hexaploid). After radiation treatment of the seeds all spikes produced by $R_1$ plants were bagged to ensure self-fertilization and note was made of their order of appearance on the plant. The $R_2$ and $R_3$ generations were classified according to the treatment given parental seeds and plants were analyzed for selected traits. The radiation treatment was effective in increasing the phenotypic variability in populations when compared to controls. Evidence was obtained that any major change in character is followed by a change in general fitness, unless the change is accompanied by an adjustment of all the genotype. It is concluded that the best way to obtain an improvement in a given trait without a loss of fitness is represented by induction of minor mutations and by use of their additive effects, leaving time for natural or artificial selection to build up balanced genotypic situations. It is pointed out that special care must be given to methodology for radiation experiments in plants as sampling methods used may give misleading results. (C.H.)

**42847** (NP-16176) [A CYTOLOGICAL STUDY OF THE EFFECTS OF RADIATION ON THE DEVELOPMENT OF THE REPRODUCTIVE ORGANS OF TWO SPECIES OF FRUIT FLIES: DACUS OLEAE AND CERATITIS CAPITATA]. Report No. 7 (Final), December 20, 1962–December 19, 1965. Baccetti, Baccio (Siena Univ. (Italy). Istituto di Zoologia e Biologia). IAEA Contract 169/R2/RB. 10p. Dep. mn.

Progress is reported on a cytological study of the effects of 5000 to 8000 R $\gamma$ or x radiation on the development of male and female reproductive organs of two species of fruit flies, Dacus oleae and Ceratitis capitata. Observations made on normal Drosophila melanogaster males are also reported. Applications of the findings in insect control using the sterile-male technique are discussed. Results showed that radiation damages spermatogones and first spermatocytes, but not spermatids. The action of radiation on male gonads appeared to be essentially mutagenic and not to involve structures that influence sperm mobility and penetration. The timing of spermatogenesis at different stages of development from larva to adult was studied in Dacus oleae by determining the type of germ cells present at each stage. Irradiation carried out during the pupal stage caused a decrease in the number of spermatozoa that reached maturity. It was concluded that the optimal time for males to be irradiated for population control is when meiotic or spermatidic sperm stages are most abundant in the gonad. Observations of radiation effects on female reproductive organs indicated that damage to ovarian structures irradiated at various doses at the pupal stage was qualitatively similar but variable in intensity. Radiation doses that caused an optimal mutagenic effect in males inhibited completely ovaposition in females because of damage to the oögonia. (C.H.)

**42848** (NP-16256) K VOPROSU O SEZONNYKH KOLEBANIYAKH RADIOCHUVSTVITEL'NOSTI KROLIKOV. (Seasonal Variations of Radiation Sensitivity of Rabbits). Pravdina, G. M.; Zagorskaya, I. B. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). 1965. 9p. Dep. mn.

Seasonal variations of radiation sensitivity and susceptibility to radiation damage was studied on 280 rabbits irradiated in various months of the year by $\gamma$ doses of 400 to 900 R. As the criterion, the magnitude of the dose resulting in 50% of survival ($LD_{50}$) was used, evaluated by the method of maximum probability. Results yielded a sinusoidal curve with the maximum $LD_{50}$ dose in January differing from the minimum July dose by 175 R. The authors prepared a table for the correction of the rabbit $LD_{50}$ value as a function of the month of the year. A comparison of the newly obtained curve with those of temperature variations of the air, the level of solar radiation, relative humidity of the air, and the length of daylight seem to point towards an essential connection between these effects, but further studies in this direction are necessary for pinpointing the underlying mechanism. (JPRS)

**42849** (NP-16258) K VOPROSU OB OBSHCHIKH PROBLEMAKH RADIOCHUVSTVITEL'NOSTI ORGANIZMA. (The Problem of General Radiation Sensitivity of Organisms). Gorizontov, P. D.; Darenskaya, N. G.; Domshlak, M. P.; Tsypin, A. B. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). 1965. 37p. Dep. mn.

A detailed survey on overall radiation sensitivity of entire living organisms and its comparison with the sensitivity of individual systems is presented. Separate sections deal with the sensitivity of particular species, the sensitivity differences within an individual species, age dependent sensitivity, sex-conditioned sensitivity, seasonal sensitivity, and individual sensitivity to radiations. It is concluded on the basis of considerable experimental evidence that one must use distinct approaches during studies of radiation sensitivity and radiation damage and that radiation damage depends in a definite manner on the state of the nervous system, endocrine glands, blood system, the level of exchange processes, and other physiological parameters. (151 references.) (TSS)

**42850** (NYO-2043-130) THE APPLICATION OF NUCLEAR ENERGY TO AGRICULTURE. Triennial Report, July 1, 1963–June 30, 1966. Moh, Carl C. (Inter-American Inst. of Agricultural Sciences, Turrialba (Costa Rica)). Contract AT(30-1)-2043. 171p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Applications of atomic energy in the development of improved strains of agricultural plants, better control of plant diseases and insect pests, and the proper management and use of soils are discussed for countries in the American tropics. Results are reported from studies on the $\gamma$ radiosensitivity of a number of tropical plant species; the $\gamma$ radiosensitivity of seeds of various tropical Pinus species; a study of $\gamma$-induced mutations in Phaseolus (bean) species; the effects of low temperature on mitosis and radiosensitivity of bean shoots; a cytogenetic study of Manihot esculenta (cassava, yucca), an important source of carbohydrate in tropical countries; tracer studies ($^{35}S$) of sulfur metabolism in the photosynthetic bacteria, Rhodospirillum rubrum and in cacao seeds; and the effects of cold temperature on the development of cacao seeds. The use of $\gamma$ radiation for the control of Mediterranean fruit fly, Ceratitis capitata, the tropical warble fly, Dermatobia hominis, the parasitic larvae of which cause cutaneous myiasis in cattle, and the coffee leaf miner, Leucoptera coffeella was investigated. Results are reported from extensive studies on the biology of these species. The chemical properties, fertility, and effects of fertilizers on recent volcanic ash soils were studied. Phosphates, labeled with $^{32}P$, were used to study the movement of inorganic substances between host and parasitic plants. Rain water samples were collected for fallout analysis. A list is included of publications during the period covered by this report. (C.H.)

**42851** (NYO-3274-9) BIOCHEMISTRY AND PHYSIOLOGY OF IRRADIATED FRUITS AND VEGETABLES. Annual Technical Progress Report, September 4, 1965–September 3, 1966. Massey, Louis M. Jr. (New York State Agricultural Experiment Station, Geneva. Dept. of Food Science and Technology). May 31, 1966. Contract AT(30-1)-3274. 77p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Progress is reported on studies of the chemical, biochemical, and physiological responses of fresh fruits and vegetables to doses of $\gamma$ ionizing radiation used for radiation processing for the extension of storage life. Data are presented from studies of the physiological origin of softening in carrot tissues brought about by radioinduced changes in cell permeability to water; radioinduced changes in intermediary metabolism in fresh fruits and vegetables, with emphasis on citric acid; carbohydrate metabolism in carrots, and the radioinduced degradation of pectin in apples. The biochemical mechanism of apple scald control by low dose radiation was also investigated. (C.H.)

**42852** (ORO-2903-28) STUDIES IN THE USE OF IONIZING RADIATION AS STIMULI. Progress Report, June 1, 1965–May 31, 1966. Smith, James C. (Florida State Univ., Tallahassee. Dept. of Psychology). May 30, 1966. Contract AT(40-1)-2903. 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Progress is reported in studies on: the effects of $^{60}$Co $\gamma$ radiation on the development of saccharin or water preference by rats and the effects of removal of olfactory bulbs on preference development; the response of rats and pigeons to x radiation used as a warning stimulus and the effects of removal of the olfactory bulb on the response; and investigations of visibility curves of a variety of insects and preliminary studies on the sensitivity of the moth eye to $\beta$ particles and visible light. (C.H.)

**42853** (ORO-3299-1) EFFECTS OF IONIZING RADIATION ON PLANT SPECIES, POPULATIONS, AND ECOSYSTEMS. Progress Report, September 1, 1965–August 31, 1966. McCormick, J. Frank (North Carolina Univ., Chapel Hill). Sept. 1, 1965. Contract AT(40-1)-3299. 40p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Data are presented from a study of the effects of $\gamma$ radiation on natural ecosystems of a tropical forest. The forest selected for study is a lower montane rain forest located at 425 m elevation on El Yunque mountain in the Luquillo Experimental Forest of eastern Puerto Rico. Preliminary ecological studies of the area were made in 1963. One site was continuously exposed to a 10,000 C $^{137}$Cs $\gamma$ source from Jan. 19 to April 19, 1965. Radiation effects were estimated by comparing data collected before and after irradiation of the experimental forest, by comparison of data collected along a radiation intensity gradient, and by comparing the experimental and control forests before and after irradiation, with emphasis on the diversity and density of seedlings. Preliminary results indicated that tropical forests are more tolerant to radiation than temperate forests. Doses of 5000 R had no effect on seedling abundance or diversity and doses of 25,000 to 35,000 R did not kill seedlings of many tropical species. (C.H.)

**42854** (TID-23127) PROGRESS REPORT [ON $O_2$ CONSUMPTION: $CO_2$ ACCUMULATION, AND $N_2$ BALANCE IN MOUSE RADIATION CHIMERAS, 1962–65]. McArthur, W. H.; Congdeon, C. C. (Knoxville Coll., Tenn. Oak Ridge National Lab., Tenn.). Contract AT(40-1)-3011. 21p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Progress is reported on studies of oxygen consumption, $CO_2$ accumulation, and nitrogen balance in mouse radiation chimeras. The etiology of secondary disease that frequently kills irradiated mice transplanted with foreign bone marrow was investigated. Mice given foreign bone marrow injections after lethal doses of x radiation stayed in positive nitrogen balance for 90 days even in the presence of a small weight loss. It is postulated that this disease represents a metabolic disturbance initiated by the graft against host immune reactions. Oxygen consumption in mice given foreign bone marrow was slightly higher than in given isologous bone marrow. A higher degree of parasitic flagellate infection was found in mice given foreign bone marrow injections than in those given isologous injections. (C.H.)

**42855** (TID-23203) BASIC STUDIES OF THE IMMUNE RESPONSE AND THE EFFECT OF RADIATION ON THIS RESPONSE. Progress Report, June 1, 1965–May 31, 1966. Dixon, Frank J. (Scripps Clinic and Research Foundation, La Jolla, Calif. Dept. of Experimental Pathology). Contract AT(04-3)-410. 11p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Progress is reported in studies of the etiology and pathology of glomerulonephritis in sheep and rats. Results of immunologic, chemical, and electron microscopic studies indicate this spontaneous disease is induced by complex antigen-antibody reactions. The effects of x radiation on immune responses of rabbits to keyhole limpet hemocyanin (KLH, a soluble protein antigen) and passive antibodies were studied. The in vivo behavior of heterologous antikidney antibodies was studied in rats. The suppression of primary antibody formation by passively transferred antibody shortly after antigenic stimulation and the immunologic responsiveness induced by a variety of antigens were studied in rabbits. Publications during the period covered by this report are listed. (C.H.)

**42856** (TID-23213) THE EFFECTS OF X IRRADIATION ON METABOLISM OF GLUCOSE IN THE INTACT RAT. Marks, Darrell Lee (Oregon State Univ., Corvallis). June 1966. Contract AT(45-1)-1387. 116p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Thesis.

Radiorespirometric data on $^{14}CO_2$ evolution from $^{14}$C specifically labeled glucose by normal rats indicated that normal rats metabolize glucose mainly via the EMP-TCA sequence. Smaller but significant portions of the glucose were routed into the pentose phosphate pathway and the glucuronic acid pathway. Immediately after x irradiation of rats at 800 R, the time course data for $^{14}CO_2$ evolution from $^{14}$C specifically labeled glucose indicated that the EMP-pyruvate decarboxylation pathway was drastically inhibited. Greater portions of the administered glucose were routed into the pentose phosphate pathway and the glucuronic acid pathway. Fructose-6-phosphate derived from glucose via the PP pathway engaged more extensively in the operation of the pentose cycle pathway. At 80 hours after x irradiation at 800 R, the operation of the EMP-pyruvate decarboxylation pathway was still inhibited, although by less extent than that obtained with rats immediately after irradiation. Of greater interest was the much more predominant role of the pentose cycle pathway and the glucuronic acid pathway in glucose catabolism in the rat 80 hours after x irradiation. No change was found in nicotinamide coenzyme levels or NADH oxidase activity between normal rats and irradiated rats that could account for the large inhibition of the EMP pathway in glucose catabolism by x irradiation. The observed change in the catabolic picture of rats after x irradiation leads one to speculate that the enzyme F-6-p kinase, or some other enzyme in the immediate subsequent steps of the EMP scheme, may have been preferentially inhibited by x irradiation. (157 references.) (auth)

**42857** (TID-23228) A STUDY OF THE PHYSIOLOGICAL FUNCTION AND HISTOLOGICAL CHANGES IN THYROIDS IRRADIATED WITH RADIOACTIVE IODINE. Annual Report, June 1, 1965–June 1, 1966. Dobyns, Brown M. (Western Reserve Univ., Cleveland, Ohio. School of Medicine). July 1, 1966. Contract AT(30-1)-1243. 8p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Progress in clinical and experimental studies of the effects of radiation on the thyroid is reported. Clinical studies included investigations of radiation effects on thyroid function, nuclei in thyroid tissue, and chromosomes in circulating leukocytes of patients treated with $^{131}$I. Experimental data were collected on rats administered $^{131}$I and were concerned with DNA synthesis in irradiated and antithyroid-drug stimulated rats and with nuclear changes at the time of neoplasm formation in rat thyroids. (H.G.D.)

**42858** (UCRL-16246, pp 74-83) RADIOSENSITIVITY OF THE VESTIBULAR APPARATUS OF THE RABBIT. McDonald, Larry W.; King, Gerald A.; Tobias, Cornelius A. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

A method of irradiating the inner ear of the rabbit with an alpha-particle beam without significant exposure of the brain was devised. Long lasting changes in semicircular-canal function of the rabbit was demonstrated with doses of 500 rads. The approaches used to determine the threshold of radiosensitivity of the semicircular-canal function and the radiosensitivity of the macula utriculi are described. Structural changes are discussed that may account for the functional alterations observed. Work being undertaken to study the structural changes is described. (auth)

**42859** (UCRL-16246, pp 100-2) DIFFERENTIAL CYTOLOGIC EFFECTS OF NEGATIVE PION BEAMS IN PLATEAU AND "STAR" REGIONS. Preliminary Report. Loughman, William D.; Winchell, H. Saul; Aceto, Henry; Richman, Chaim; Raju, Mudundi R.; Lawrence, John H. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

LAF$_1$ mice carrying the Ly2 lymphoma as an ascites tumor were exposed to the negative pion beam of the 184-in. cyclotron (including its muon and electron contaminants). Mice exposed in the plateau region of the pion beam received 65 to 80 rads, with the beam estimated to contain about 64% pions. Mice exposed in the star region of the pion beam received 80 to 95 rads, with the beam estimated to contain less than 50% pions. Cytological examination of lymphoma cells aspirated from mice at various time intervals following pion irradiation was performed. Four characteristics were scored: mitotic index; frequency of polyploid metaphase cells; frequency of anaphase cells displaying bridges; and chromosome counts of metaphase cells. Results indicated a greater RBE for negative pions in star region than for those in the plateau region. (H.G.D.)

**42860** (UR-49-687, pp 1-65) RADIATION EFFECTS: GENERAL. (Rochester Univ., N. Y. Atomic Energy Project).

Abstracts are presented on 31 publications during 1965 in the field of radiobiology and related studies. Bibliographic information is included. (C.H.)

**42861** (NSJ-tr-53) EFFECTS OF GAMMA IRRADIATION ON TULIP. II. EFFECTS ON VARIOUS STAGES OF THE DEVELOPMENT. Matsubara, Hisao; Iba, Shozo; Oka, Mitsuru; Meshitsuka, Gisuke. Translated from Tokyo Metrop. Isotop. Centre Ann. Rep., 2: 157-62(1963). 10p. Dep. mn. JCL $1.10 fs, $0.80 mf. JAERI.

Tulip bulbs and plants were exposed to $^{60}$Co gamma rays in the various stages from before the flower bud differentiation (July) to the appearance of flower bud (March). Dosages employed were 0.5, 1.0, and 3.0 KR at dose rates 16 × 10 R/hr and 14 × 10$^3$ R/hr. The higher dose irradiation in the early stages (July to Oct.), remarkedly reduced the germination (emergence) percentage, plant growth, and flowering percentage. Shapes, numbers, and distribution of red spots and streaks in the petals depended on the stage of petal formation at the time of irradiation. Abnormal petals with vertical incisions and parrot flowers were observed in the tulips irradiated 0.5 KR in the early stages of petal formation. Chimeric variegation in flower color was observed in the tulips irradiated to 3.0 KR in stage one. Abnormal petals did not appear in the late stage irradiation. Narrow width petals were observed in the case of high dose irradiation in the late stages of petal formation (Nov. to Jan.). These results suggested that ionizing radiations are useful for morphogenetic studies of plant. (auth)

**42862** MICROANGIOGRAPHIC STUDIES ON CHANGES IN THE CEREBRAL VESSELS AFTER IRRADIATION. I. LESIONS IN THE RABBIT PRODUCED BY $^{60}$Co $\gamma$-RAYS, 195 kv and 34 MV ROENTGEN RAYS. Hassler, O.; Movin, A. (Univ. of Umea, Sweden). Acta Radiol. Therapy, Phys., Biol., 4: 279-88(Aug. 1966).

Forty-seven rabbits received a moderate dose of $\gamma$ rays or 195 Kv or 34 Mv x rays to a field covering one cerebral hemisphere. After 1 to 360 days the brains were studied by microangiographic and histologic methods to determine the relationship between vascular and parenchymatous changes. No distinct changes were observed 1 to 90 days after irradiation. Small petechial hemorrhages were observed after 90 days in irradiated brain areas and edema was observed 30 to 90 days after irradiation. Well developed telangiactases were observed 196 days after irradiation and were located almost exclusively in the white matter. (C.H.)

**42863** ULTRAVIOLET RADIATION AND MORAXELLA BOVIS IN THE ETIOLOGY OF BOVINE INFECTIOUS KERATOCONJUNCTIVITIS. Hughes, D. E.; Pugh, G. W. Jr.; McDonald, T. J. (Dept. of Agriculture, Ames, Iowa). Amer. J. Vet. Res., 26: 1331-8(Nov. 1965).

Exposure to uv radiation from a mercury sunlamp was found to enhance the effect of *Moraxella bovis* infection of the bovine eye, the resulting disease being indistinguishable from field cases of bovine infectious keratoconjunctivitis (pink-eye). *M. bovis* infection alone produces only a mild disease; however, with daily doses of middle range uv light (2800 to 3200 Å), *M. bovis* infection caused severe clinical signs of keratoconjunctivitis. It is therefore concluded that uv light may be a primary etiologic factor in this disease. Excessive irradiation with uv can produce similar signs to those of the disease. In one experiment, eyes irradiated with the sunlamp became infected with *M. bovis*, although infectious material was not inoculated or instilled into the eye. The irritation caused the cattle to rub their heads against the stalls, and in this manner the organism was probably transferred to the nonexposed eye. The use of uv light makes possible the study of the disease under controlled conditions at any time of year. The ability to reproduce the disease should aid in study of problems associated with bovine infectious keratoconjunctivitis. (BBB)

**42864** THE INFLUENCES OF THE LEVEL OF PROTEIN INTAKE ON THE ALTERATION OF LIVER WEIGHT AND LIVER COMPOSITION IN WHOLE-BODY $^{60}$Co GAMMA IRRADIATED RAT. Kenmoku, A.; Kazimoto, T.; Iwao, H. Ann. Rpt. Nat. Inst. Nutr. (Tokyo), 36-7(1964).

Weanling Wistar male rats were divided into two groups of 8 and 25 per cent casein diet. After four weeks, each group was subdivided into two groups — a control group and a group which was exposed to 600 R of $^{60}$Co gamma radiation. At three and 12 hr after irradiation, livers of both irradiated and control groups were excised and weighed. Aliquots of the liver were used for determination of water and crude fat. No difference was found in liver weight at three hr after irradiation between the control and the irradiated rat in both the 8 and 25 percent casein groups. Concentration of liver water and fat of the irradiated rats did not show the same tendency as the liver weight. The water concentration was moderately high in the irradiated rat in comparison with the control. At 12 hr after irradiation, the liver weight of irradiated rats was greater than the controls in both casein groups. Water concentration was again higher in irradiated than in control groups, but in contrast to water levels, the fat levels were lower in the irradiated group after 12 hr. (W.E.B.)

**42865** HUMAN EFFECTS OF CHRONIC, LOW DOSE RADIATION. Sagan, Leonard A. Arch. Environ. Health, 13: 345-50(Sept. 1966).

Implications for adjudication of compensation claims for radiation injury are discussed. Although acute symptoms may follow as little as 100 rads delivered at one time, a much larger dose can be tolerated if the radiation is given over a period of time. Late effects of radioisotopes depend partly on distribution of the isotopes in the body and partly on the RBE of neutrons, x rays, beta particles, and protons. Shielding of any part of the body has a protective effect. Certain organs of the body are more radiosensitive than others. Bone marrow, gonads, and the gastrointestinal tract are among the most radiosensitive. Young individuals are more sensitive to radiation than old. Three characteristics of late radiation effects which greatly hamper a better understanding of late effects following low dose irradiation are: nonspecificity, latency, and rarity of late effects. Techniques of data collecting are described. Data have been collected from the following groups of people: patients with a history of medical or industrial exposure; survivors of atomic bombs in Japan; American radiologists; men who served as radiology technicians during World War II. All of these studies have been limited by a lack of accurate dose estimates. A study now in progress offers promise of overcoming limitations of previous studies. A study supported by the Atomic Energy Commission is being conducted at the University of Pittsburgh School of Public Health. This is an investigation of mortality of many thousands of AEC contractor employees whose exposure was carefully monitored and recorded over the years. A discussion is given of evidence relating radiation exposure to injury. (H.L.W.)

**42866** CYTOLOGY AND CYTOCHEMISTRY OF RIBONUCLEOPROTEINS IN CELLULAR MITOCHONDRIA AND TIGROID OF THE CENTRAL NERVOUS SYSTEM DURING LATENT PERIOD OF RADIATION DAMAGE. Shabadash, A. L.; Zelikina, T. I.; Agracheva, N. D. (Inst. of Biological Physics, Moscow). Ark. Anat., Gistol. Embriol., 44: 3-9(1963). (In Russian).

A sorption of dye cations depends on the number of substrate free phosphoric acid groups dissociated at any given pH of medium. The complex RNP undergoes important changes caused by the effect of gamma and x irradiation; blockade of part of phosphoric acid radicals results in the shift of RNP isoelectric point (IEP) towards the alkaline side. Therefore mitochondria in neurons from the irradiated animal are not revealed by staining at the initial pH values, optimal when staining similar structures (or tigroid) in controls. Nevertheless the phenomenon in question does not mean "disappearance" of mitochondria as the latter may be fully stained in other slices of the same series at a suitable pH (more alkaline). The "sham" disappearance of mitochondria points to deep changes in physical and chemical properties of RNP, notwithstanding the fact, that microscopical structure of the organoids remained intact. Serious cytochemical disturbances in mitochondria as well as in tigroid of the central nervous system cells are taking place from the first moment of the whole-body irradiation until the development of marked clinical syndrome of the disease. Functional pathology of mitochondria in neurons of the most important types predisposes disintegration of normal correlations in the body. (auth)

**42867** PATHOLOGICAL ANATOMY OF EXPERIMENTAL RADIATION LEUKEMIA IN MICE. Svyatukhin, M. V.; Sorokina, Yu. D.; Turgunov, M. B. (Inst. of Experimental and Clinical Oncology, Academy of Sciences, USSR). Arkh. Patol., 28: 13-18(1966). (In Russian).

A pathologico-anatomical picture of leukemia occurring after a whole-body x-irradiation of mice is described. Myeloid leukemia with a simultaneous presence of the cells of various degrees of maturity was observed in the mongrel mice. In mice of the C-57 Bl strain there were almost exclusively lymphatic leukemias with the affection of the thymus, generally characteristic of mice of this strain. Along with this, there were encountered cases referred to the group of reticuloses. A number of peculiarities were detected that were characteristic of differential features in pathological anatomy of each of the leukemia types. Especially characteristic of lymphatic leukemia is affection of the thymus, preponderant involvement of lymphatic follicles and perivascular spread of the infiltrates in the lung. The following is typical of myeloid leukemia: the initial spread of the infiltrates beyond the lymphatic follicles, the absence of perivascular infiltrates in the lungs, overfilling of their capillaries with leukemic cells, and the presence of cellular thrombi in the small branches of the pulmonary artery. (auth)

**42868** IRRADIATION OF NERVE FIBER WITH SOFT X-RAYS AND THE INFLUENCE OF BEAM ENERGY UPON THE NERVAL EXCITATION THRESHOLD. Vanselow, K. (Univ., Kiel). Atomkernenergie, 11: 414-17(1966). (In German).

A brief review of radiobiological research of the "Institut fuer Angewandte Physik" is represented. It comprises irradiation of nerve fiber with soft x rays and results in developing a theory of the mechanism of nerval excitation threshold. This theory starts from the supposition of electrostatic-mechanic equilibrium of pressure at the resting nerve membrane. An above-threshold-level stimulus displaces this equilibrium and induces a variation of permeability of the membrane. Ionizing radiation also displaces this equilibrium as is seen from a variation of the original threshold level. The influence of beam energy on this variation is studied at constant dose. Experiments were made with the nervus ischiadicus of Rana temporaria. Very soft x rays were applied so that the decrease of intensity with depth became considerable and had to be taken into account. The variation of threshold level shows a dependence on x-ray beam energy, which is linear with the path length of the photo electrons. This effect is well explained if we suppose that the variation of threshold level depends on the probability with which the spur of an electron is crossing the membrane of a Ranvier node. (auth)

**42869** PHOTOREACTIVATION: A RADIATION REPAIR MECHANISM ABSENT FROM MAMMALIAN CELLS. Cleaver, J. E. (Massachusetts General Hospital, Boston). Biochem. Biophys. Res. Commun., 24: 569-76(Aug. 23, 1966).

Photoreactivation is a repair mechanism associated with the recovery of organisms from damage caused by ultraviolet light and has been demonstrated in many microorganisms and some higher organisms. Results are reported from an investigation of photoreactivation in four types of mammalian cells using an experimental system with which photoreactivation was easily demonstrated in other organisms. Results indicated that the effects of ultraviolet light were not modified to any extent by illumination with light. Data are summarized from published results of studies on 9 cultured cell lines, hamsters and mice that confirm the absence of photoreactivation in mammalian cells. Possible reaction mechanisms involved in the absence of photoreactivation in mammalian cells are discussed. (C.H.)

**42870** CHANGES IN PROTEIN FRACTIONS OF BLOOD SERUM IN IRRADIATED RABBITS INJECTED WITH BONE MARROW AND SOME MICROELEMENTS. Minasyan, S. M. Biol. Zh. Arm., 19: No. 5, 18-25(May 1966). (In Armenian).

In the literature there are few references to the effects of myelotherapy on albumin exchange. A study of the modification of the albumin fraction of blood serum of irradiated animals under the combined effects of bone marrow transfusions and injections of trace elements was reported. The tests were made on 48 rabbits aged 5 to 6 months and weighing from 2.5 to 3 kg. The animals were exposed to a single whole-body irradiation with the RUM-11 apparatus at a total dose of 900 R. All the animals were divided into three groups: the first group was the control group consisting of 8 rabbits, the second consisted of 20 rabbits in which bone marrow was introduced a day after irradiation, and the third group received solutions of trace elements for 10 days after the transfusion of the bone marrow. The solutions injected were 20 mg of iron ascorbate, 1 mg of koamide, 0.5 mg of $CuSO_4$, and 0.1 mg of $MnCl_2$ per 1 kg body weight of the animal. The iron ascorbate and $CuSO_4$ were introduced by mouth and the others subcutaneously. For evaluation of the weight pattern and outcome of the radiation sickness, the general clinical indication and the peripheral blood picture were used. The concentration of the total albumin in the blood serum was determined by refractometry. The albumin fraction by means of paper electrophoresis, and the total and residual nitrogen in the blood serum by the Kjeldahl method. The results obtained indicated that the combined treatment during radiation treatment of transfusion of bone marrow and microelement injection affects not only the regeneration of the blood producing organs, but has a favorable effect on the albumin exchange of the blood serum in irradiated animals. This is indicated by (1) the comparatively unimportant increase of the nitrogen fraction of the blood serum; (2) insignificant change of the quantity of total albumin; (3) the insignificant change of the albumin-globulin coefficients and electrophoretic mobilities of the albumin of the blood serum; and (4) the change of the albumin and nitrogen fraction of the blood serum of irradiated animals with non-effective transplantation of bone marrow (lost) in basic analogy to the behavior in the control test. (tr-auth)

**42871** REGENERATION OF LOCALLY IRRADIATED BONE MARROW. I. DOSE DEPENDENT, LONG-TERM CHANGES IN THE RAT, WITH PARTICULAR EMPHASIS UPON VASCULAR AND STROMAL REACTION. Knospe, William H.; Blom, Johannes; Crosby, William H. (Walter Reed Army Inst. of Research, Washington, D. C.). Blood, 28: 398-415(Sept. 1966).

Locally irradiated rat bone marrow was uniformly depressed during the first week after x-radiation doses of 2000 to 10,000 rads. The early appearance of hematopoietic regeneration between 7 and 14 days at all dose levels suggested an influx of stem cells from unirradiated sites. Between 2 and 6 months postirradiation a second wave of hematopoietic depression occurred at all dose levels and was correlated with the disappearance of the sinusoidal microcirculation. Between 6 and 12 months diffuse hematopoietic regeneration occurred only at the 2000 rad level and could be correlated with regeneration of the sinusoidal microcirculation. No significant hematopoiesis or sinusoidal regeneration was observed at the higher dose levels after 6 months or 1 year. Although large vascular channels developed, indicating circulation through the marrow cavity, the characteristic and essential anatomy of the microcirculation was not restored. (auth)

**42872** EFFECT OF X RAYS ON THE PROLIFERATIVE ACTIVITY OF STEM CELLS DERIVED IN CULTURE FROM LYMPHOCYTES OF NORMAL HUMAN BLOOD. **Astaldi, G.; Costa, G.; Penna, R. (Ospedale Civile, Tortona, Italy). Boll. Soc. Ital. Biol. Sper., 40: 2183-6(1964). (In Italian).**

A dose-dependent radiation-induced inhibition of the multiplication of cultured lymphoid cells was demonstrated. Blood from normal persons (50 ml) was centrifuged and the leukocytes were cultured in NCTC-109 fluid (2000 cells/ml). To 7.6 parts of this culture fluid, 2 parts calf serum, and 0.4 parts of a 1 : 25 dilution of phytohemagglutinin were added. This phytohemagglutinin acts as a stimulant of leukocyte proliferation. Cultures were incubated for 60 hr at 37° and exposed to x rays in 11 graded doses ranging from 20 to 700 R. Colchicine in optimal amounts (0.25 μg/ml) was added and 72 hr later the stathomokinetic index was determined. It was evident that low doses (20 to 100 R) were proportionately more effective than higher doses (200 to 500 R) in inhibiting the proliferative activity of phytohemagglutinin-stimulated lymphocytes. (BBB)

**42873** CARCINOGENESIS IN NATURALLY TUMOUR-RESISTANT MICE. X-IRRADIATION VERSUS URETHANE AS A CARCINOGENIC AGENT. Goldfeder, Anna; Kauffman, Shirley L.; Ghosh, Ajit Kumar (New York Univ.). Brit. J. Cancer, 20: 361-74(June 1966).

The combined effects of chemical carcinogens plus x irradiation were studied on mice of the X/Gf strain. Urethane was administered alone and in combination with x irradiation. The occurrence of lymphomas, mammary tumors, vascular tumors, and lung adenomas is reported. The relation of viral, chemical, and radiation carcinogenesis is discussed with a view toward explaining the mode of neoplasm induction. (R.E.U.)

**42874** THE EFFECT OF $\gamma$-RAYS ON THE ACETYLCHOLINE LEVEL IN INSECTS. Grzelak, K.; Lassota, Z. (Inst. of Biochemistry and Biophysics, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Biol., 14: 391-5(1966).

The diapausing pupae of Celerio euphorbiae were irradiated with a single 1000 kR dose of $^{60}$Co $\gamma$ rays at a rate of about 200 kR/hr. Within 2 hrs after irradiation the lethargic pupae as well as nonirradiated control ones of similar weight (1.9 ± 0.2 g) were bled, sectioned, and the fat body was discarded. The residual tissues were separated from the cuticula and immediately plunged into 10 percent trichloroacetic acid. The average wet weight of tissues to be analyzed, prepared from 1 gm of whole pupa was about 0.22 gm. Tissues from 3 individuals were usually collected in 4 ml of 10% trichloroacetic acid and the mixed sample was homogenized in a glass homogenizer. The eggs of Bombyx mori were irradiated at diapause with a single dose of 20 kR of $^{60}$Co $\gamma$ rays at a rate of about 200 R/min. At a given stage of embryogenesis 1 gm of eggs was homogenized in 4 ml of 10 percent trichloracetic acid. The quantities of acetylcholine in the homogenates were determined colorimetrically after separation on paper chromatograms. Irradiation caused an immediate increase in acetylcholine content of pupal tissues and a delayed increase of acetylcholine in irradiated eggs was correlated with the differentiation of the nervous system of the embryo. (C.H.)

**42875** SOME ASPECTS OF ACETYLCHOLINE METABOLISM IN THE SYMPATHETIC GANGLION OF IRRADIATED RABBITS. Klimovskaya, L. D.; Maslova, A. F. Byull. Eksp. Biol. Med., 61: No. 6, 50-3(June 1966). (In Russian).

The content of free and associated acetylcholine was measured in the tissue of the superior cervical sympathetic ganglion before and after stimulation of the preganglionic fibers in control and irradiated rabbits. It was shown that irradiation with $\gamma$ rays in a dose of 400 R caused in the majority of animals a reduction of the amount of acetylcholine, which was possibly due to the damage done to the mechanisms responsible for the synthesis and reservation of the mediator. (auth)

**42876** DETECTION OF C- AND C$_x$-REACTIVE PROTEIN IN THE IRRADIATED BLOOD SERUM DURING EXPOSURE OF THE BODY TO ULTRAHIGH FREQUENCY ELECTROMAGNETIC WAVES. Chukhlovin, B. A.; Grachev, B. N.; Likina, I. V. Byull. Eksp. Biol. Med., 61: No. 6, 54-5(June 1966). (In Russian).

The content of C-reactive protein in the human blood serum and of C$_x$-reactive protein in the rabbit blood serum during a dosed exposure of the body to microwaves. It has been found that C$_x$-reactive protein is detected in rabbits exposed to electromagnetic waves of an intensity larger than 10 mW/cm$^2$. Radiations of less intensity may increase the amount of C$_x$-reactive protein in the rabbit blood serum in case it was present in the serum by the time of irradiation. Electromagnetic waves with a flux density of 2 to 3 mW/cm$^2$ fail to cause the appearance of C-reactive protein in the blood serum of healthy subjects. (auth)

**42877** MITOGENETIC RADIATION OF THE CARDIAC MUSCLE OF ANIMALS UNDER NORMAL PHYSIOLOGIC CONDITIONS. Gurvich, A. A.; Eremeev, V. F. (Inst. of Normal and Pathological Physiology, Moscow). Byull. Eksp. Biol. Med., 61: No. 6, 56-8(June 1966). (In Russian).

Experiments on mitogenetic radiation of the heart muscle of frogs and rabbits were performed in vivo on conscious and anesthetized animals. The radiation spectrum of the heart muscle is normally represented mainly by broad bands, which reflect the orderly molecular pattern of the sarcoplasma substrate. Narrow spectral bands appear during narcosis. This change is attributed to the alteration of molecular orderliness and demonstrate the importance of central control in the regulation of molecular rearrangement in the normal heart muscle. (auth)

**42878** THE IMMUNOLOGIC REACTIVITY OF RADIOCHIMERAS. THE ROLE OF THE DONOR CELLS AND ANTIBODIES IN RESISTANCE OF RADIOCHIMERAS TO DIPHTHERIA TOXIN. Kaulen, D. R. (Gamalen Inst. of Epidemiology and Microbiology, Moscow). Byull. Eksp. Biol. Med., 61: No. 6, 62-5(June 1966). (In Russian).

The resistance of immunized guinea pig–radiochimeras to diphtheria toxin was studied. It was shown that the resistance of radiochimeras was due to the donor hematopoietic tissue and was dependent upon the antitoxin titer in the blood. (auth)

**42879** INFLUENCE OF X-RAYS ON THE PROGENY OF RATS IRRADIATED WITH 200 r ON THE NINTH DAY OF THEIR EMBRYONAL DEVELOPMENT. Nikonov, A. P. (Grodno Medical Inst., USSR). Byull. Eksp. Biol. Med., 61: No. 6, 94-7(June 1966). (In Russian).

The development of progeny obtained from rats exposed to x rays in a dose of 200 R on the ninth day of their embryonal development was studied. The investigations revealed a considerable reduction of the survival rate, sharp variations in the rate of increase of body length and body weight, and a decrease in the capacity for adaptation to environmental conditions. The most severe derangements were noted in progeny produced by crossing irradiated females with irradiated males, related by blood. (auth)

**42880** MORPHOLOGIC CHANGES IN THE THYMUS AND SPLEEN OF NEWBORN MICE EXPOSED TO LOCAL IRRADIATION WITH X RAYS IN A MASSIVE DOSE. Goncharenko, I. M.; Fridenshtein, A. Ya. (Gamalen Inst. of Epidemiology and Microbiology, Moscow). Byull. Eksp. Biol. Med., 61: No. 6, 103-7(June 1966). (In Russian).

Mice of strain C57Bl were exposed to x rays in a dose of 3,000 R on the first day after birth. This was accompanied by a practically complete destruction of mature forms of thymus lymphocytes (thymocytes), which made it possible to produce a model of an organ devoid of thymocytes but with a fully retained structure of the elements of its stroma for a period up to three weeks. The restoration of the thymus structure took place by the 22nd day after irradiation; simultaneously, there occurred complete development of the spleen structure, which was retarded until this moment. It is supposed that restoration of the thymocytes is due to repopulation by lymphocytes from other organs. (auth)

**42881** DYNAMICS OF MORPHOLOGICAL CHANGES IN THE INNERVATION SYSTEM OF THE MENINGES IN DOGS WITH A SEVERE FORM OF ACUTE RADIATION SICKNESS. Izmailova, G. M. Byull. Eksp. Biol. Med., 60: No. 7, 118-21(July 1965). (In Russian).

The innervation system of the brain meninges at different stages of a severe form of an acute radiation sickness was studied in dogs irradiated (650 to 900 R) and killed at different times after irradiation. The nerve elements of the dura mater and pia mater of the brain and spinal cord were identified by Campos' silvering method. The nerve elements exhibited symptoms of irritation very early after irradiation (in 1 to 2 hrs) that were apparently of protective and reversible character. Subsequent destructive changes aggravated the receptor elements and myelin fibers. The greatest changes were found in the pia mater covering the brain stem. The data obtained suggest that the early changes in the innervation elements of the meninges may play a certain role in disturbance of the cerebral circulation as well as in the origination of certain symptoms of an acute radiation sickness, for example, headache. Destructive changes arising in subsequent periods of the development of the disease apparently aggravate disorders in the blood and cerebrospinal fluid circulation in the central nervous system under the action of ionizing radiation. (auth)

**42882** ELECTRON MICROSCOPY STUDIES OF ULTRASTRUCTURES OF THE THYMUS CELLS IN THE S57BL STRAIN MICE SUFFERING FROM RADIATION LEUKEMIA. Shubin, A. S.; Turgunov, M. T. (Inst. of Experimental and Clinical Oncology, Moscow). Byull. Eksp. Biol. Med., 60: No. 8, 110-11(Aug. 1965). (In Russian).

Thymus cells were studied by electron microscopy in six C57Bl mice with radioinduced leukemia or thymic lymphoma and in three control mice. Vacuolization of mitochondria and an increase in nuclear volume were noted in leukemic animals. Comparable changes were not observed in thymus cells from non-irradiated mice. Viral inclusions were absent from leukemic cells. (H.G.D.)

**42883** EFFECTS OF GAMMA RADIATION ON THE BIOLOGY AND BEHAVIOR OF ADULT IPS CONFUSUS (LeCONTE) (COLEOPTERA: SCOLYTIDAE). Wood, D. L.; Stark, R. W. (Univ. of California, Berkeley). Can. Entomol., 98: 1-10(Jan. 1966).

The feasibility of using irradiation techniques for bark beetle control was investigated in the California five-spined ips, Ips confusus, which was selected from among the many available destructive scolytid species because of its high abundance in nature, ease of rearing in the lab, short life cycle, and the advanced status of knowledge about its biology and behavior. Sterilization of male and female ips exposed to $\gamma$ radiation ($^{60}$Co) as newly emerged adults was almost complete at levels exceeding 7500 and 10,000 R, respectively. Mating behavior of males as expressed by sperm transfer was unaffected by doses up to 60,000 R. The capacity of beetles of either sex to establish galleries in trees was not affected significantly below this dose, but female gallery pattern was altered above 15,000 R. Longevity was reduced at levels greater than 5000 R. The $LD_{50}$ for males occurred at 11.5 days at 7500 R and 29 days in the controls. Mortality of progeny resulting from males irradiated at substerilization levels was higher than in the controls. The dose to achieve significant population reduction with min effect on longevity and other biological activity is estimated to lie between 6000 and 7500 R. It is concluded that this sterilization technique may have promise in the control of bark beetles. The necessity for rearing large numbers on artificial media could be circumvented by mass trapping utilizing their natural sex attractant and by mass rearing in host material in the lab. (BBB)

**42884** DISTRIBUTION OF MITOTIC PHASES IN ERYTHROBLASTS IN PERSONS EXPOSED TO SMALL DOSES OF IONIZING RADIATION. Novakova, E. (Inst. of National Health, Jachymov Mines, Pribram, Czech.). Cas. Lek. Cesk., 104: 575-9(May 28, 1965). (In Czech).

The mitotic indices of erythroblasts in 15 healthy subjects without occupational exposure to ionizing radiation and a group of 10 subjects exposed chronically to small doses of external radiation combined with internal irradiation from naturally radioactive elements were compared. No statistically significant difference was found between the mitotic indices of erythroblasts in the two groups. In subjects exposed to chronic small doses of radiation a small but statistically significant drop of the ratio of prophases and metaphases was present with a corresponding increase of anaphases and telophases. It was concluded that the repeated action of small amounts of ionizing radiation inhibits slightly the proliferation of erythroid elements. (C.H.)

**42885** EFFECTS OF IONIZING RADIATION ON OSMOREGULATION IN FISH ONCORHYNCHUS KISUTCH. Conte, Frank P. (Oregon State Univ., Corvallis). Contract 14-17-001-1162. Comp. Biochem. Physiol., 15: 293-302(July 1965).

Decreased survival occurred for juvenile coho salmon following doses of x radiation $\geq$1000 R when transferred from hypo-osmotic to a hyperosmotic environment (0‰–30‰ salinity). Survivors which had remained in salt, and fresh water 60 days post-irradiation were sacrificed for plasma sodium chloride and osmotic concentrations. Increased levels ($P < 0.005$, $>0.01$) were noted between the control (0 R) and the irradiated ($\geq$ 1200 R) group of saltwater fish; while no significant elevations occurred between irradiated and non-irradiated fish remaining in fresh water. Sites of histopathological changes in saltwater fish were found principally in the extrarenal system (gills, caecae and intestine) with severe damage noted in the gill lamellae. No damage was apparent in the kidney. No histopathological changes were noted in fish receiving the same amount of irradiation but which remained in fresh water. (auth)

**42886** TEST OF EXPERIMENTAL DEMONSTRATION OF THE BIOLOGICAL ACTIVITY OF NATURAL IONIZING RADIATIONS. Planel, Hubert; Soleilhavoup, Jean-Pierre; Blanc, Daniel; Fontan, Jacques; Tixador, Rene (Faculte de Medecine, Toulouse. Faculte des Sciences, Toulouse). Compt. Rend., Ser. D, 262: 2767-70(June 27, 1966). (In French).

The growth of cultures of Paramecia, with and without reestablishment of the initial level of radioactivity (thorium nitrate) in the lead shielded vessels was studied in order to verify the biological action of natural ionizing radiations. The results showed that the presence of a radioactive source in the culture vessels compensates for the inhibiting effect of the shielding. The growth inhibitions observed under shielded vessels are related to the partial absorption of natural ionizing radiations. (H.L.W.)

**42887** HYPERPRODUCTION OF DIPHTHERIA AND TETANUS ANTIBODIES FOLLOWING IRRADIATION BEFORE THE SECOND INJECTION. Loiseleur, Jean; Girard, Olivier; Petit, Michelle (Institut Pasteur, Paris). Compt. Rend., Ser. D, 262: 2791-2(June 27, 1966). (In French).

Guinea pigs were injected with a mixture of diphtheria and tetanus anatoxins. After a period of 90 days the animals were given a second injection. Two days before this injection the animals were divided into three groups: unirradiated controls, a second group given 50 R whole body x rays, a third group given 100 R x rays to right front leg. After whole body irradiation, there was a considerable increase in tetanus antibodies, while the localized irradiation caused an increase in diphtheria antibodies. It is important to use small doses for whole body irradiation and larger doses for localized irradiation. X radiation causes a significant increase in the amount of antibodies. (H.L.W.)

**42888** GROWTH OF CELLS FROM IRRADIATED EXPERIMENTAL FIBROSARCOMA OF C3H MICE. Malaise, Edmond; Tubiana, Maurice (Institut Gustave-Roussy, Villejuif, France). Compt. Rend., Ser. D, 263: 292-5 (July 18, 1966). (In French).

The radiosensitivity of tumor cells has been studied in vitro and in vivo. This study has made it possible to estimate percentages of cells surviving different doses of x rays and to calculate growth rates. In the 14 days following radiation the surviving cells have a higher rate of multiplication than that of cells from unirradiated tumors of the same age. (H.L.W.)

**42889** SUPPRESSION BY X IRRADIATION OF THE SYNGENIC PREFERENCE PHENOMENON PRESENTED BY TWO ISOLOGOUS SARCOMAS INDUCED BY METHYLCHOLANTHRENE AND DIBENZANTHRACENE. Oth, D.; Burg, C. (Faculte de Medecine, Nancy. Faculte des Sciences, Nancy). Compt. Rend. Soc. Biol., 159: 2231-4 (1965). (In French).

In an attempt to define the mechanism responsible for syngenetic preference in mice, the role of x irradiation of the hybrid F1 on the take rate of two tumors was studied. Two tumors CB1 or TP 10 were grafted on non-irradiated F1 hybrids and on F1 hybrids receiving a dose of 350 R for the TP 10 tumor and doses of 450, 500, and 550 R for the CB1 tumor. The grafts were made 24 hrs after the irradiation. The results showed that a dose of 350 R on the animals receiving the TP 10 tumor increases the take rate of 47.5% for the non-irradiated hybrids to 75% for the irradiated hybrids. For the CB1 tumor a dose of 450 R increases the take rate only slightly. On the contrary, the doses of 500 and 550 R increased the take rate 100%, suppressing the syngenetic preference displayed by the tumor. (J.S.R.)

**42890** EVIDENCE OF AN IMMUNITY IN THE CBA MOUSE GRAFTED WITH SARCOMA J. Chevalier, P. (Univ., Liege). Compt. Rend. Soc. Biol., 159: 2271-4 (1965). (In French).

It is shown that in the CBA mouse the grafting of sarcoma J provokes an antitumor immunity. Whole-body x-irradiation or the administration of cortisone prior to grafting accelerate development, probably due to an inhibition of immunity. Surgical removal of a primary graft inhibits the development of additional grafts, a phenomenon still detectable after 10 months. It is concluded that in CBA mice the appearance of a certain degree of immunity is compatible with the development of tumor tissue. The development of sarcoma J is partially inhibited by host immunization, but development continues until death of the animal. (tr-auth)

**42891** STUDY OF THE DEVELOPMENT OF PULMONARY ADENOMAS IN MICE OF VARIOUS STRAINS AFTER TREATMENT OF URETHANE ASSOCIATED WITH X RAYS. Chouroulinkov, I.; Riviere, M. R.; Arnold, J.; Guerin, M. (Institut de Recherches Scientifiques sur le Cancer, Villejuif, France). Compt. Rend. Soc. Biol., 160: 234-7(1966). (In French).

The development of pulmonary adenomas in mice of 5 different strains was studied for 6 months after the application of urethane and of a whole-body x irradiation, used alone or in association. Marked differences of response were noted in the different strains. The most conclusive results were found in the Swiss mouse. In these mice with a high rate of urethane-induced pulmonary tumors, the x rays appear to decrease the incidence. The association of x rays and urethane lowers the percentage of pulmonary adenomas. (tr-auth)

**42892** CONSIDERATION ON THE HISTOGENESIS OF THYMIC LYMPHOMAS INDUCED BY WHOLE BODY X IRRADIATION IN MICE OF VARIOUS STRAINS. Riviere, M. R.; Chouroulinkov, I.; Guerin, M. (Institut de Recherches Scientifiques sur le Cancer, Villejuif, France). Compt. Rend. Soc. Biol., 160: 238-41(1966). (In French).

A whole body x irradiation in a single dose or fractionated doses on mice of different strains induces lymphomatoses, some of which can be studied in their initial stages. In the AKR, C57 BLACK, and Swiss mice if the origin of these lymphopoietic tumors is most frequently thymic, the initial point of the lesions is produced frequently at the expense of one of the two thymus lobes. The invasion of the mediastinic ganglions is usually secondary; however, in rare cases the leukemic process can commence at this level. (tr-auth)

**42893** AKR LEUKEMOGENESIS AFTER X IRRADIATION FOLLOWED BY RESTORATION BY ALLOGENIC FETAL LIVER. Duplan, J. F.; Rudali, G. (Institut du Radium, Paris). Compt. Rend. Soc. Biol., 160: 274-8 (1966). (In French).

The percentage of the latency of lymphoid leukemias in AKR mice irradiated with a dose of x rays at 600 R, then restored with cells from AKR, $C^3H$, of $^{58}C$ fetal liver, were studied; the donors all possess the allele $H_2^k$. The rate of leukosis varies between 71 and 87% in the mice restored by AKR or $^{58}C$ cells, varieties with high incidence of spontaneous leukemias. On the other hand it is 15% in the AKR males and 48% in the AKR females to which $C^3H$ cells were injected. As the reaction of the graft against the host is practically the same after the restoration by the $^{58}C$ or $C^3H$ cells, the lowering of the frequency of leukemias following allogenic restoration cannot be imputed to this immunological reaction. It appears very probable that the inhibition of the leukemogenesis provoked by the $C^3H$ cells is due to the fact that these do not furnish target cells capable of being transformed into leukemic cells by the AKR virus. (tr-auth)

**42894** SENSITIVITY OF LOW- AND HIGH-ALTITUDE BARLEY TO GAMMA RAYS. Kaul, B. L. (Regional Research Lab., Jammu, India). Curr. Sci. (India), 35: 382-3(Aug. 5, 1966).

The effects of altitude on radiosensitivity were studied in two varieties of barley: one that normally grows on the North Indian plains and one that normally grows at elevations of 9000 to 12,000 ft. Radiosensitivity was measured by assaying the seedling growth and cellular abnormalities in plants arising from seeds exposed to 0, 10, 20, 30, 40, or 50 krads of gamma rays. Radioinduced reduction in seedling height was dose dependent and was accelerated significantly in the high-altitude variety. Similarly, frequency of chromosomal aberrations was generally higher in the high-altitude plants. (H.G.D.)

**42895** UNUSUAL MOVEMENT OF THE DAUGHTER CHROMOSOME GROUP IN TELOPHASIC CELLS FOLLOWING THE EXPOSURE TO ULTRAVIOLET MICROBEAM IRRADIATION. Nakanishi, Yuh H.; Kato, Hatao (National Inst. of Radiological Sciences, Chiba, Japan). Cytologia (Tokyo), 30: 213-21(June 25, 1965).

Effects of the selective uv irradiation of restricted areas of living cells were studied in the first spermatocytes of the silkworm, Bombyx mori, at the fifth instar. Partial irradiation of a single telophasic cell, involving a single spindle-pole together with one of the daughter chromosome groups, was performed with a 5-μ uv microbeam for 5 min. Immediately after irradiation, the preparation was placed under a microscope equipped with the time-lapse camera to record cellular events. The irradiated daughter chromosome group underwent a prompt change in refractive index and became consistently pale in appearance. After having reached at the irradiated pole, it began to move rapidly towards the nonirradiated, or opposite pole. After about 15 min the chromosome group came in contact with the nonirradiated chromosome group, but they did not join into a single nucleus. Two possible explanations for these findings are offered: the interzonal area of the daughter chromosome groups involves a certain force which contributes to the movement of the chromosome group; or the movement occurs in relation to cytoplasmic streaming enhanced by certain charges induced in the cytoplasm by uv irradiation. It is conceivable that a prompt change occurs in viscosity in the irradiated area, and as a result the cytoplasm around it may flow into the region, creating cytoplasmic streaming. When a pole region is irradiated, the resultant streaming may push the chromosome group out of its original position towards the equator. Thus the chromosome group is forced to move along the route formed either by the remnant of the spindle body or by the mitochondria which are arranged rather parallel along the spindle axis. Generally the volume of the daughter chromosome mass is smaller than that of the cytoplasm; this may facilitate its rapid migration. The evidence implies that the telophase chromosome groups are connected with the poles by certain elements such as astral rays. Irradiation at a pole region may damage or diminish the astral rays; as a result the daughter chromosome group may become free. (BBB)

**42896** EFFECTS OF IONIZING RADIATION ON THE CONTENT OF FAT AND STARCH IN COTTON PLANT POLLEN. Rakhimova, M. Dokl. Akad. Nauk Uz. SSR, No. 5, 45-7(1966). (In Russian).

After gamma irradiation, studies were made on morphological changes in cotton plants, and the pollen was analyzed by histochemical methods for fat and starch content. Seeds used in the experiments were air-dried and soaked and were of 108-F, C-1211, and A-719 G. hirsutum type cotton. Radiation doses from a $^{60}$Co source were as follows: 5,000, 10,000, 20,000, 30,000, 40,000, and 50,000 R. The fat content of 108-F pollen of plants grown from dry seeds irradiated with 10,000 R was identical to that of control plants. In plants exposed to 50,000 R the fat content was one-third that of the controls. The fat content in pollen of plants grown from soaked seeds irradiated with 10,000 R was very low. The content of fat and starch in pollen of plants grown from seeds irradiated with small doses of $^{60}$Co was higher than that of the controls, while with higher doses (up to 50,000 R), the content of fat and starch was much lower. (R.V.J.)

**42897** EFFECT OF $^{137}$Cs GAMMA-RAYS ON SEEDS OF THE WINTER WHEAT OF PURE LINE AND HYBRID ORIGIN. Korotkova, A. P. (Research Inst. of Agriculture of the Central Regions of the Non Chernozem Zone, Moscow). Genetika, No. 8, 30-6(Aug. 1966). (In Russian).

The effect of ionizing radiations on the mutability of five varieties of winter wheat (Gorkovtchanka, Ulianovka, Gorkovskaia 52, 4297/62 and 4300/4) differing among their origins was studied. It was found that the differences existing among the varieties were represented both by the number of new formations and the variability spectrum. The frequency and variety of the changes were considerably influenced by the hybridity grade. The highest percentage of altered plants and a broader variability spectrum were found in young hybrid varieties 4297/62 and 4300/4. The least number of changes was observed in the pure line variety-Gorkovtchanka. The altered forms most valuable from the standpoint of breeding were also isolated from varieties of a hybrid origin. (auth)

**42898** RELATIVE BIOLOGICAL EFFECTIVENESS OF HIGH ENERGY PROTONS AFFECTING CABBAGE SEEDS. Nevzgodina, L. V.; Kuznetsov, V. G.; Sychkov, M. A. (Inst. of Medico-Biological Problems, Moscow). Genetika, No. 8, 37-41(Aug. 1966). (In Russian).

The paper presents the results of investigations of the relative biological effectiveness (RBE) of protons of 126 and 657 Mev. Air-dry cabbage seeds of the Khibinsky variety were exposed to proton radiation at the Dubna synchrocyclotron and to a cobalt $\gamma$-radiation source at the dose of 0.1 to 250 krad. Cells with chromosome aberrations served as a criterion in the appraisal of the effect. It has been established that there is no difference in the effect of an exposure of cabbage seeds to 126 and 657 Mev protons and $\gamma$-rays at the dose of 0.1 to 25 krad; proton radiation at doses of 50 to 250 krad produces a biological effect twice as high as $\gamma$-radiation. An increase in the radiation doses increases the values of relative biological effectiveness of 657 Mev protons from 1 to approximately 3.5. (auth)

**42899** HIGH YIELD OF EARLY MATURING COTTON UNDER THE INFLUENCE OF GAMMA- AND NEUTRON-IRRADIATION. Nazirov, N. N.; Zhnalilov, O. (Inst. of Experimental Plant Biology, Tashkent). Genetika, No. 8, 42-7(Aug. 1966). (In Russian).

Irradiating the reproductive organs of comparatively early maturing variety of cotton C-4727-(Gossypium hirsutum) on its maternal stem, by comparatively small doses of thermal neutrons with an admixture of $\gamma$-rays and pure $\gamma$-rays, by the method of an earlier seeding of $M_1$ and annual selections the authors received a new and promising forms of cotton. Among them, the most interesting is the mutant (PL-5) received by irradiating the 30 days old bolls by $\gamma$-rays of 2 kp, which remains as early maturing as the initial plant, yields bolls 2 gr heavier than the widerspread, comparatively late maturing industrial variety 108-Φ and gives a high yield of cotton with good quality of fiber. (auth)

**42900** STUDIES IN RADIATION GENETICS OF ARABIDOPSIS THALIANA (L.) HEYNH. I. BRIEF DESCRIPTION OF THE EXPERIMENTAL PLANT AND SOME METHODS OF ITS CULTIVATION, CROSSING AND ESTIMATION OF VARIABILITY. Ivanov, V. I.; Kasyanenko, A. G.; Sanina, A. V.; Timofeeff-Ressovskya, N. A. (Inst. of Medical Radiology, Obninsk, USSR. Inst. of Physiology and Biological Physics of Plants, Dushanbe, USSR). Genetika, No. 8, 55-70(Aug. 1966). (In Russian).

In the opening paper to a series of publications to follow concerning the radiation mutagenesis in Arabidopsis thaliana it seemed desirable to discuss in some detail the questions mentioned in the subtitle. In the introductory part of the paper some general characteristics of Arabidopsis thaliana and its advantages as an object for experimental research are considered. The section on the cultivation of Arabidopsis includes some technical data on the open air, greenhouse and test tube culture. In the next section the methods of artificial cross-pollination are briefly outlined. In the last section the methods of scoring the leaf color mutations, the embryonic recessive lethals and the biochemical mutations are described. The presented data clearly show that Arabidopsis thaliana may be a useful tool in experimental, field, and theoretical botany, and, especially, in plant genetics. (auth)

**42901** RADIOSENSITIZATION OF YEASTS BY IODOACETAMIDE. Dupuy, P.; Tremeau, O. (Institut National de la Recherche Agronomique Station de Technologie Vegetale, Versailles, France). Int. J. Appl. Radiat. Isotop., 17: 521-9(Sept. 1966). (In French).

Yeasts treated with iodoacetamide ($10^{-4}-10^{-3}$ M) are sensitized to ionizing radiations. Unlike bacteria they continue to die after the end of the irradiation. In the synchronous cultures of Saccharomyces cerevisiae, at the same time as the bud appears it is possible to note an increasing resistance to radiations, and the content of SH (estimated with iodoacetamide) is 30% increased. Iodoacetamide sensitizes the budding cells more easily than the cells without bud. The cultures of Schizosaccharomyces do not contain any resistant cells, they are less sensitized by iodoacetamide. (auth)

**42902** STUDIES OF A METHOD OF INDUCING SPECIFIC LYMPHOPENIA IN DOGS. Wolf, James S.; Hume, David M. (Medical Coll. of Virginia, Richmond). J. Amer. Med. Ass., 194: 1119-21(Dec. 6, 1965).

An intraarterial implant of $^{90}$Y was used to produce specific lymphopenia in dogs without invoking any other observable detrimental abnormalities. The $^{90}$Y emitted a radiation dose of 5.5 Mrad pellets at a point midway between the implant and the aortic wall if left to disintegration. This resulted in a calculated mean circulating cell dose of 8000 rad. An implant containing seven pellets was placed in the abdominal aorta distal to the renal vessels after all branches from the renal vessels to the bifurcation were ligated and the aorta cross-clamped. A longitudinal aortotomy was made and the implant placed intraluminally. All 12 animals which received intra-arterial implants rose containing 70 mC $^{90}$Y showed profound lymphopenia which developed within 12 hr after implantation. The lymphocyte counts fell to 0% to 10% of preradiation levels, and lymphocyte levels below 500/mm$^3$ were maintained for about three weeks, after which they returned slowly to normal. During the first three days following irradiation, many large lymphocytes appeared with vacuoles and chromatin-clumping in the nuclei. These cells disappeared after the first week, and presumably were degenerating lymphocytes resulting from radiation injury. Neither thrombosis nor necrosis of the aorta was seen in any of the irradiated animals. Microscopic examination of mesenteric lymph nodes showed a prompt decrease in cellularity. This was most marked in the germinal follicles where there was first loss of small lymphocytes and then loss of the entire follicular architecture. Aortas showed good preservation, with only some endothelial scarring. Bone-marrow biopsies showed an increase in myelopoiesis, normal erythropoiesis, and loss of lymphocytes. (TCO)

**42903** EFFECT OF PREVIOUS IRRADIATION ON THE TRANSFORMATION OF BLOOD LYMPHOCYTES. Millard, R. E. (Royal Marsden Hospital, London). J. Clin. Pathol., 18: 783-5(Nov. 1965).

The transformation of blood lymphocytes to blast cells in cultures with phytohemagglutinin was studied in five patients before and at intervals up to 18 to 19 months after therapeutic irradiation with 2-Mev x rays of the abdomen and pelvis with doses of 3200 to 4475 R. In the control cultures, before radiotherapy, the percentage of blast cells ranged from 19% to 39% and the mitotic index from 1.6% to 8%. In one patient, all cultures showed satisfactory lymphocyte transformation. In four patients transformation was depressed following irradiation. In three of these patients the duration of the depression was short; in one patient it was prolonged for over a year. The poor response of the lymphocytes to phytohemagglutinin was not associated either with leukopenia or with a high incidence of cells with chromosome abnormalities in the cultures. No attempt was made to determine whether the failure of some lymphocytes to transform was a direct effect of the x rays on the lymphocytes (and perhaps related in some way to the chromosome aberrations), or an indirect effect due to a circulating substance in the blood. It would be of interest to try the effect of washing the cells before culture. The effect of serum from irradiated subjects on the transformation of blood lymphocytes from nonirradiated subjects should also be investigated. If the effect of x rays is a direct one on the lymphocytes themselves, it is surprising that the irradiation of a limited part of the body could affect an appreciable proportion of the blood lymphocytes. However, extensive recirculation of lymphocytes from the blood to the lymph via the lymph nodes can occur. With the repeated irradiation of lymph nodes over a period of several weeks, it is probable that large numbers of lymphocytes would be exposed to x rays. Further observations are required to determine whether the altered response of the lymphocytes to phytohemagglutinin is a specific effect of abdominal and/or pelvic irradiation, or whether it is a more general feature following the irradiation of lymphoid tissue elsewhere in the body. (BBB)

**42904** THE EFFECTS OF GAMMA-RAY IRRADIATION OF CERTAIN SPECIES OF STORED-PRODUCT INSECTS. Dennis, Norman M. (Dept. of Agriculture, Savannah, Ga.). J. Econ. Entomol., 54: 211-12(Feb. 1961).

A preliminary study was made on the effects of $\gamma$ rays from radiocobalt on several species of stored-product insects. The tests were done to determine the minimum lethal radiation doses for adults and immature forms of stored-grain infesting insects. A study of sterility effects produced by sublethal dosages to the confused flour beetle adult, Tribolium confusum, was also undertaken. An 11 C $^{60}$Co source was used to treat the test insects. The mortalities obtained in the various exposure periods are given in a table. An exposure to 100,800 R killed all of the confused flour beetle adults and larvae, saw-toothed grain beetle adults, lesser grain borer adults, granary weevil adults, rice weevil adults, Indian-meal moth larvae, and the almond moth larvae within 2 months. An exposure to 151,200 R killed the saw-toothed grain beetle adults, confused flour beetle adults and larvae, and Indian-meal moth larvae within 6 days. Confused flour beetles exposed to 8400 R did not reproduce during a 2-month period after exposure, but the test insects in the control series reproduced normally. (BBB)

**42905** EFFECTS OF $^{60}$Co (GAMMA RADIATION) ON THE MELANOPHORES OF GAMBUSIA AFFINIS AND MOLLIENISIA LATIPINNA. Killebrew, Rosamond; Brou, Lin (Louisana State Univ., Baton Rouge). J. Miss. Acad. Sci., 11: 197-204(1965).

Gamma radiation from a $^{60}$Co source caused disorganization of melanophores fish of the Gambusia and Mollienisia strains. High doses of $\gamma$ radiation caused the melanin granules to diffuse through the cell membrane rapidly, and complete disorganization occurred in a few days. Low doses of radiation caused the melanin to lump before dispersing. Complete disorganization occurred in 60 days. Disorganization of the melanophores was slower in large fish. (auth)

**42906** EFFECTS OF $^{60}$Co IRRADIATION OF EUGLENA GRACILIS (K$_1$). Killebrew, Rosamond; Winkler III, Joseph A. (Louisana State Univ., Baton Rouge). J. Miss. Acad. Sci., 11: 205-8(1965).

Cobalt-60 irradiation of Euglena gracilis (K$_1$) produced deleterious effects such as erratic swimming patterns and changes in morphology and color as doses increased. E. gracilis demonstrated a measurable degree of radiosensitivity and considerable radioresistance. It was concluded that radiation has played a more significant part in the story of evolution than other mutagenic agencies since it embodies the phenomena of heat, light, and the ability to produce or initiate tremendous chemical changes in the living cell as well as chromosome aberration. (auth)

**42907** FURTHER OBSERVATIONS ON THE EFFECT OF X-RAY IRRADIATION ON THE FATE OF $^{35}$S-LABELED VACCINE IN MOUSE BODY. Tsukamura, Michio; Tsukamura, Sumio (Obuso National Sanatorium, Nagoya, Japan). Jap. J. Tuberc., 13: 1-5(July 1965).

The spleen and the liver of the x-irradiated mice could not fix the $^{35}$S-labeled, heat-killed mycobacterial vaccine so firmly as did the organs of the control mice. One day after vaccination, the mitochondrial and microsome fractions of the spleen of the irradiated animal contained much less of the radioactivity derived from the vaccine. Seven days after vaccination, the difference in the specific radioactivity in the subcellular fractions became less significant between the control group and the irradiated group, and fourteen days after vaccination such specific radioactivity became very low in the irradiated animals. (auth)

**42908** CHANGES IN THE BLOOD IRON CONTENT AND ERYTHROPOIESIS INDEXES UNDER THE INFLUENCE OF RADIATION. Skulme, K. A.; Prane, L. Yu. (Inst. of Experimental and Clinical Medicine, Riga). Klin. Leche. Zlok. Novoobrazov., Akad. Med. Nauk SSSR, Latv. Inst. Eksp. Klin. Med., 10: 143-58(1964). (In Russian).

A one year study was made on 123 persons; 40 were healthy people of whom some were exposed to $\gamma$ radiation (total daily dose 0.01 to 0.02 R), others to $^{60}$Co, $^{32}$P, $^{65}$Zn, $^{137}$Cs, $^{85}$Sr, etc. Women (83) with cancer were treated by irradiation. Of the 40 healthy people 31 had an average of 53.1 mg % Fe content. No direct relation was established between the Fe index and blood morphology. Of the 83 cancer cases 65 had an average of 41.9 mg % Fe. The erythrocyte and hemoglobin were also lower. Hypoferremia in the cancer cases was not always accompanied by anemia. Least Fe and hemoglobin changes were in patients receiving external $\gamma$ teletherapy. Similar Fe changes were found in 26 of 41 patients who showed no particular health problems during the course of treatments, in 12 out of 21 with slight illness, and in 10 out of 21 with considerable illness. Slight Fe change was predominant in the cases that showed complete destruction of the malignancy and fairly good health or only slight illness during radiation therapy. Most of the uterine cancer cases revealed reduced Fe content with a tendency to secondary hypochromic anemia. Deep local radiation therapy of uterine cancer patients who were given a diet enriched with proteins and vitamins C and B brought about a slight reduction of the whole blood Fe and negligible reduction in the erythrocyte count. Administration of vitamins C and B during radiation treatment did not affect the Fe fluctuations in the whole blood but reduced or even prevented reduction of hemoglobin, erythrocytes, and reticulocytes. (tr-auth)

**42909** THE EFFECT OF THE VOSTOK-5 AND VOSTOK-6 FLIGHTS ON PRIMARY ROOTLET CHROMOSOMES OF SOME HIGHER PLANT SEEDLINGS. Delone, N. L.; Rudneva, N. A.; Antipov, V. V. Kosm. Issled., 3: 480-7 (May-June 1965). (In Russian).

Dry seeds of some higher plants (carrot, tomato, pine, bean, cucumber, wheat, lettuce, and mustard) were carried on the Vostok-5 and Vostok-6 flights to study the genetic effect of space-flight factors. After the flight, the seeds were grown, and primary rootlets were fixed when they reached a length of 2 to 15 mm (depending on the plant). Cells in the anaphase and telophase were studied to determine the number of general chromosomal rearrangements (fragments and bridges). When cell nuclei of the meristem, normally in the interphase state, are irradiated, the chromosome splits and then duplicates itself, resulting in chromosome rearrangements. In the controls, another type of rearrangement that occurs more frequently was the chromatid rearrangement, i.e., when the chromatid breaks after it reduplicates. Cytological analysis showed a statistically reliable increase in the number of general chromosomal rearrangements in carrots and tomatoes, a tendency to increase in pine trees and beans, and some tendency to increase in cucumbers and wheat. No difference was noted between experimental and control mustard plants. It is interesting that for the same plant variety, the percentage of rootlet cells with general chromosomal rearrangements after both flights was very close. It was found that chromosomal rearrangements predominated in the experimental samples, and chromatid in the controls. This distribution was also observed after the first 4 Vostok flights (pea and wheat rootlets). The order of sensitivity obtained experimentally does not coincide with the sensitivity to gamma radiation of dry seeds of these plant varieties. More recombinations of chromosomes (bridges) than fragments were observed in experimental samples, as distinguished from the controls. (ATD)

**42910** STUDY OF THE PHAGE PRODUCTION OF E. COLI K-12 (λ) INDUCED DURING THE FLIGHTS OF VOSTOK-3 AND VOSTOK-4. Zhukov-Verezhnikov, N. N.; Maiskii, I. N.; Pekhov, A. P. (and others). Kosm. Issled., 3: 488-91(May-June 1965). (In Russian).

Lysogenic bacteria [E. coli K-12 (λ)] were used on the Vostok-3 and Vostok-4 flights as an indicator of the biological effect of cosmic radiation. Samples of the bacterial suspension were kept in the laboratory and at the launch site to serve as controls. All samples were kept on ice. After the flight the number of viable cells and the level of induced phage production were determined. A special antiphage serum, which inactivated spontaneously produced phage particles was added after preliminary incubation under optimum conditions. Induced phage production was studied 48, 72, 96, and 120 hr after the spacecraft landed. Results showed that the number of cells producing phage particles in experimental samples significantly exceeded the number in the controls (4.6 and 3.5 times for Vostok-3 after 48 and 72 hrs, respectively). Such a statistically reliable difference was not observed 96 and 120 hr after landing. On Vostok-4, the experimental samples produced 1.86 to 2 times more phage particles 48 to 72 hr after landing. The increase in the number of phage-producing cells on these flights shows the stimulating effect of space factors on E. coli K-12 (λ). This effect was more pronounced on Vostok-3 and is apparently attributable to the greater length of that flight. Experimental results showed that the stimulating effect is retained 48 to 72 hr after landing, after which phage production drops to the spontaneous level. These data agree with results of research on the stimulating effect of protons on lysogenic bacteria. The stimulating effect observed is apparently related to the complex influence of vibration, acceleration, and weightlessness, which may increase the sensitivity of lysogenic bacteria to cosmic radiation. (ATD)

**42911** INVESTIGATION OF THE BIOLOGICAL EFFECT OF SPACE-FLIGHT FACTORS USING LYSOGENIC BACTERIA IN EXPERIMENTS ON VOSTOK-5 AND -6. Zhukov-Verezhnikov, N. N.; Maiskii, I. N.; Pekhov, A. P.; Antipov, V. V.; Rybakov, N. I.; Kozlov, V. A. Kosm. Issled., 3: 492-4(May-June 1965). (In Russian).

The genetic effects of space flight on lysogenic bacteria were studied, and a chemical means of protection was investigated. The chemical agent was β-mercaptopropylamine, a substance which blocks the formation of induced phage particles during x-ray and gamma irradiation. As in eight earlier flights (four Sputnik and four Vostok), a suspension of E. coli K-12 (λ) was used. The bacteria were divided into three groups: experimental samples, laboratory controls, and controls kept at launch site. Each group contained some untreated samples and some with β-mercaptopropylamine (0.05% concentration) added before flight. After each flight the number of viable bacteria was determined, and an analysis of phage particles was made. Experimental results showed that the number of phage particles in untreated experimental samples significantly exceeded the number in the launch-site controls (3.68 times for Vostok-5). It was also established that phage formation in these experiments on Vostok-5 and Vostok-6 was about the same as during Vostok-3 and Vostok-4. Thus, space-flight factors have a stimulating effect on lysogenic bacteria, as demonstrated by the statistically reliable increase in phage production. However, no direct relationship between this stimulating effect and the length of exposure of the bacteria in space has been detected. Under space-flight conditions, β-mercaptopropylamine almost completely prevents the formation of induced phage particles. In addition, this substance significantly lowers the level of spontaneous phage formation. The protective effect of β-mercaptopropylamine consists of its ability to block the genetic reaction of formation of induced phage. Since the number of viable cells in control and experimental samples was the same, no conclusion can be made about the protective action of this substance against the lethal effects of space flight. (ATD)

**42912** BIOLOGICAL STUDIES CARRIED OUT IN COSMIC SATELLITES "VOSKHOD I" AND "VOSKHOD II". Zhukov-Verezhnikov, N. N.; Maiskii, I. N.; Delone, N. L.; Rybakov, N. I.; Kozlov, V. A.; Davydov, V. V.; Anminov, V. V.; Saksonov, P. P.; Rybakova, K. D.; Tribulev, G. P. Kosm. Issled., 4: 634-40(July-Aug. 1966). (In Russian).

Experiments were performed on the Voskhod-1 and Voskhod-2 spaceships to test the effects of spaceflight on lysogenic cultures of E. coli K-12 (λ). The cultures were carried in 1.5-ml ampules on board spaceships and in Leonov's spacesuit pocket during his EVA. Some of the ampules contained the radioprotective drug β-mercaptopropylamine. Controls were kept at the cosmodrome and at the home laboratory. Results showed that on the basis of viability there was no difference between samples carried on Voskhod-1 and the controls. Experiments on Voskhod-2 resulted in a slightly higher viability on the part of experimental cultures as compared to controls. Phage production of experimental cultures carried on the two flights also did not exceed phage production of controls. Thus, it was not possible to demonstrate the protective properties of β-mercaptopropylamine. An attempt was made to determine whether spaceflight sensitized lysogenic cultures of E. coli K-12 (λ) to consequent exposure to small doses of x-rays. Results showed that phage production in space-flown samples was almost identical to that of the controls. In addition, air-dried seeds of pine and winter wheat (PPG-186) were carried on Voskhod-2 and in Leonov's pocket during his EVA for the purpose of determining the genetic effects of space-flight factors. Results did not reveal any substantial differences between the two spaceflight-exposed groups of seeds and the controls. It is assumed that the absence of the effects of spaceflight factors on lysogenic bacteria and seeds of higher plants in these two flights is due to the particular conditions under which these flights took place. (tr-auth)

**42913** THE EFFECT OF SOME CHEMICALS ON REJOINING OF CHROMOSOME BREAKS. I. POSTIRRADIATION TREATMENT WITH 2,4-DINITROPHENOL. **Yamaguchi, Hikoyuki; Tatara, Atsushi (Tokyo Univ.). Kromosomo, 51-52: 1740-2(Aug. 1, 1962). (In Japanese).**

On the basis of the concept that chromosome breaks may stay open for relatively long periods after irradiation of dormant seeds, a study was performed to investigate the effect of a metabolic inhibitor on repair of chromosomal breaks after irradiation of dormant seeds. After $^{60}$Co $\gamma$ irradiation of dormant seeds of Vicia faba, the beans were treated with $10^{-4}$ M 2,4-dinitrophenol. Irradiation consisted of a total dose of 7500 R at a dose rate of 750 R/hr. Two days later, when the first cell divisions were occurring in the root tips, anaphase cells were scored for chromosomal aberrations. It was found that the application of dinitrophenol prevents the radiation-induced breaks from rejoining. Control (untreated) cells showed aberrant chromosomes with a frequency of 3.0%, $\gamma$-ray-treated cells 19.7%, 2,4-dinitrophenol-treated cells 12.4%, and cells treated with both 36.5%. Thus treatment with dinitrophenol alone resulted in relatively high appearance of aberrant cells. Dinitrophenol is an inhibitor of ATP formation; it is possible that spontaneous mutations are caused by metabolic products accumulated as a result of such inhibition. (BBB)

**42914** EFFECT OF $\gamma$ RAYS AND FAST NEUTRONS ON AMINO ACID BIOSYNTHESIS BY THE CULTURE MICROCOCCUS GLUTAMICUS, STRAIN 22. Grivina, P. (Inst. of Microbiology, Latvian Academy of Sciences). Latv. PSR Zinat. Akad. Vestis, No. 5, 116-21(1966). (In Latvian).

Under the effects of $\gamma$- and fast-neutron irradiation, the survival of strain 22 of Micrococcus glutamicus decreases and the number of mutations increases with increasing radiation dose. The effect of fast neutrons both on the surviving cells and on the induction of mutations is greater than that of $\gamma$ rays. The radiation dose intervals in which the mutations are produced and the sensitizing of specific amino acids were calculated for $\gamma$ rays and fast neutrons. Among the active mutants produced, 3 mutants under laboratory conditions synthesize 2.3 times more lysine, 2.5 times more glutamic acid, and almost 4 times more alanine than the original cultures of Micrococcus glutamicus. (tr-auth)

**42915** ALTERATIONS OF THE RADIATION EFFECT ON PLANTS DEPENDING ON CATIONIC COMPOSITION OF THE NUTRIENT MEDIUM. **Miller, A.; Oinase, D. Latv. PSR Zinat. Akad. Vestis, No. 7, 74-9(1966). (In Russian).**

The biological effectiveness of acute gamma irradiation on plants was studied in dependence on the cationic composition of potassium, magnesium, and calcium in the nutrient medium. It was established than an excess of bivalent cations of calcium and magnesium exerts a favorable effect on regeneration processes in plants grown from irradiated seeds and reduces the adverse effect of radiation on growth and productivity of plants. The monovalent potassium cation manifests less influence on the radiation effect than the bivalent ions. (auth)

**42916** RADIATION-INDUCED CALCIUM RELEASE FROM PLANT TISSUES. **Al-Jasim, H.; Markakis, P. Contract AT(11-1)-1282. Mich. State Univ., Agr. Exp. Sta., Quart. Bull., 47: 505-7(1965).**

Calcium-45 was incorporated in plant tissues and the tissues were exposed to "pasteurizing" (200−600 kilorad) doses of gamma rays from cobalt-60 and 1-Mev electrons. The extracts of the irradiated tissues contained more radiocalcium than those of the non-irradiated controls. Irradiation of calcium pectate also resulted in calcium release. It is concluded that calcium dislodgement from plant tissues by irradiation may contribute to the radiation-induced softening of fruits and vegetables. (auth)

**42917** EFFECTS OF IONIZING RADIATION ON THE ZINC CONTENT OF THE PANCREAS. **Ginzburg, M. B. (Zoological Inst., Moscow). Mikroelem. Sel'sk. Khoz. Med., Ukr. Nauch.-Issled. Inst. Fiziol. Rast. Akad. Nauk Ukr. SSR, Mater. Vses. Soveshch., Kiev, 1962, 618-21 (1963). (In Russian).**

Male rats were divided into 3 groups; 110 were used as controls; 99 were given 1000 R whole-body radiation; 196 were given whole-body multiple radiation with doses of 1.5 and 10 R for 2 to 6 months, the total dose being 150 to 1000 R. The rats were killed and analyzed for zinc content of the pancreas. There was a reduced zinc content in irradiated rats and the reduction was related to the stage of radiation injury. The blood sugar was normal in all groups. (H.L.W.)

**42918** A NOTE ON THE MECHANISM OF UV MUTAGENESIS IN ESCHERICHIA COLI. **Bridges, Bryn A. (Radiobiological Research Unit, Harwell, Eng.). Mutat. Res., 3: 273-9(Aug. 1966).**

Recent results on uv-induced reversion to prototrophy in Escherichia coli were incorporated in a hypothesis in which it is postulated: that two distinct uv-induced lesions in DNA are involved in the production of mutations, say events A and B; that event A is a type of lesion known as thymine dimer-type damage that can be removed by photoreactivation (requiring light) or by the excision-repair (host-cell reactivation) system; that event B is rapidly removed (mutation-frequency decline) by a repair enzyme that needs an energy source but not a nitrogen source and which is inhibited by amino acids or concomitant RNA and protein synthesis. Event B is also probably excisable by the host-cell reactivation system but is not monomerizable by the photoreactivation enzyme; and that events of type A act in mutagenesis by inhibiting the mutation-frequency decline enzyme and thus increasing the number of fixed mutations all of which arise from events of type B. (auth)

**42919** EFFECTS OF RECURRENT MUTAGENIC TREATMENT IN DURUM WHEAT. **Mugnozza, G. T. Scarascia; Monti, L. M. (National Committee for Nuclear Energy, Rome). Mutat. Res., 3: 298-304(Aug. 1966).**

The effects of x-ray and ethylenimine (EI) treatments on durum wheat and the possibility of a synergistic effect of the two agents when applied alternately were investigated. For x rays, a 15,000 R exposure was used, and for EI a 0.4‰ (w/v) concentration was applied for 2 hrs at 20°. Analysis of chlorophyll mutation and mutant frequencies showed that in the x-recurrent experiment the frequency of mutations rose from 3.33% to 6.29% and that of mutant seedlings from 3.82% of 7.75%. In the EI-recurrent experiment some inconstancy in mutagenic action of EI was found; for the same reason, the EI−x and the x−EI recurrent experiments showed an increase in mutation and mutant frequency only in correspondence with x-ray treatments. Since in the 4th and 5th years of the experiment a discrimination was made between freshly-induced mutations and mutations induced in previous generations, it was ascertained that in x-recurrent and in EI−x recurrent treatments the frequency of mutations induced by the last treatment was about 50% higher than after the first x-ray treatment. No statistically significant difference was found between the mutation spectra induced by single and recurrent x-ray treatments. The slight increase in mutation frequency and the lack of differences in mutation spectra after repeated mutagenic treatments in these experiments might be due to the extensive diploidization of the durum wheat material. (H.G.D.)

**42920** CHROMATID AND CHROMOSOME ABERRATIONS IN IRRADIATED DRY SEEDS OF VICIA FABA. **Brunori, A.; Avanzi, Silvana; d'Amato, F. (Univ., Pisa, Italy. National Committee for Nuclear Energy, Rome). Mutat. Res., 3: 305-13(Aug. 1966).**

DNA-spectrophotometric analyses have shown the contemporary occurrence of nuclei with 2C and 4C DNA amounts in the radicle meristems of dry (resting) seeds in two varieties of *Vicia faba* (var. *major* and var. *minor*). The frequency of 2C and 4C nuclei shows great variation from seed to seed within a seed sample, and the average percentage of 4C cells is different in the two seed samples. When seeds of the variety *minor* are irradiated with 1500 R of x rays in the dry state and germinated in water containing $^3$H-thymidine, the first post-irradiation mitoses to appear are unlabeled, thus demonstrating that most, if not all, 4C nuclei in dry seeds are actually $G_2$ cells. All these cells respond to radiation with chromatid aberrations (B′). Among labeled mitoses ($G_1$ cells in the resting seed) that appear in the first 30 hrs of germination (presumably late $G_1$ cells in resting seeds) anaphases with B′ predominate; at later times after germination, labeled anaphases with chromosome breaks, or B″ (presumably mid and/or early $G_1$ in resting seeds), are the most frequent. Data are presented indicating that, in resting *V. faba* seeds, late $G_2$ shows a greater radiation sensitivity than mid and/or early $G_2$, and that $G_1$ comprises developmental stages with different radiation sensitivities. (auth)

**42921** EFFECTS OF X-IRRADIATION ON THE MEIOSIS OF VICIA FABA. **Ecochard, Rene (European Atomic Energy Community, Wageningen, Netherlands). Mutat. Res., 3: 314-26(Aug. 1966).**

Plants of *Vicia faba* with buds at all stages of development were exposed to a range of doses of x rays at a dose rate of 50 R per min. The effects of irradiation in the pollen-mother-cell chromosomes and pollen formation were studied. A method based on the regularity of flower development, under constant environmental conditions, was used to relate the observed disturbances to the stage of buds at irradiation time. Irradiations given in early meiotic prophase (leptotene) resulted in chromatic aberrations, namely bridges and fragments in anaphase, producing micronuclei in interkinesis. The number of fragments and micronuclei was found to increase more than linearly with exposure in the range of from 25 R to 100 R. Micronuclei in tetrads, and dwarf pollen grains found later, are the result of the previous aberrations. They show a similar dose relationship which, in the case of the tetrads, could be adjusted to an equation of the form $aD + bD^2$, and the relative contribution of one-hit and two-hit events was calculated in the range of doses studied. The present results are compared with other published data. The radiosensitivity expressed in terms of chromatid aberrations induced at leptotene was found to be comparable to the radiosensitivity of root-tip chromatids induced in $G_2$, and could be accounted for by the specific nuclear factors of the species considered. (auth)

**42922** FITNESS AND COMPETITIVE ABILITY IN IRRADIATED POPULATIONS OF DROSOPHILA MELANOGASTER. **Dyer, K. F. (Radiobiological Research Unit, Harwell, Eng.). Mutat. Res., 3: 327-39(Aug. 1966).**

Experiments are described in which a population of flies was given an acute 1500 rad dose of x rays every generation and then allowed to compete with a genetically similar but unirradiated population. The accumulation of second chromosome recessive lethal mutations was measured to provide an estimate of the total genetic damage, and it was found that over 35% of the chromosomes carried these by generation twelve. The rate of accumulation was found to agree fairly well with a straightforward theoretical prediction. The competitive ability of the irradiated population as measured by the number of flies emerging appeared to be well maintained and was, by generation twelve, only slightly inferior to its unirradiated counterpart. The decline in the number emerging from generation one to twelve could largely be accounted for by the genetic deaths due to homozygous recessive lethals. Flies heterozygous for irradiated chromosomes, however, appeared to have a reduced competitive ability. The significance of these different responses to genetic damage in terms of the structure of the gene pool is discussed. (auth)

**42923** DIFFERENTIAL SENSITIVITY OF DESYNAPTIC AND NORMAL GENOTYPES OF BARLEY TO X-RAYS. **Riley, Ralph; Miller, T. E. (Plant Breeding Inst., Cambridge, Eng.). Mutat. Res., 3: 355-9(Aug. 1966).**

The desynaptic (ds) mutant of barley, *Hordeum vulgare*, was used to determine the differences in x-radiosensitivity of homozygous recessive (ds) and homozygous dominant (Ds) genotypes. Hulled seeds were treated in air with single 8000, 10,000, or 12,000 R doses of x rays delivered at approximately 500 R/min. Irradiated seeds were germinated on moist filter paper at 24°, and radioinduced aberrations in root tips were scored as reunions. Neither genotype showed any reunions in the unirradiated controls. Following x-irradiation, there were significantly more reunions in ds ds material than in Ds Ds material. Since the regression of mean reunions per cell of ds ds on Ds Ds genotypes had a slope significantly greater than unity, it was concluded that a real difference exists in the x-radiosensitivity of the two genotypes. (H.G.D.)

**42924** SURVEY OF COUPON HOLDERS AMONG ATOMIC BOMB CASUALTIES WHO VISITED HIROSHIMA UNIVERSITY PSYCHIATRIC DEPARTMENT—PRELIMINARY SURVEY REPORT. **Takahashi, Hikaru (Hisisan Hospital, Japan. Hiroshima Univ.). Nagasaki Igakkai Zasshi, 38: Suppl., 85-9(Dec. 1963). (In Japanese).**

The number of patients being treated in the Department of Psychiatry, Hiroshima University Hospital from January 1, 1961 to June 30, 1962 was 3106, 4.8% of whom were atomic bombing survivors. Medical records are reviewed for 60 males and 88 females with an age range from fetal (intrauterine exposure) to 70 years of age at exposure. There were 70 cases of psychosis (47.3%), 27 of neurosis (18.2%), 9 with nervous system syndrome (6.1%), and 27 other psychic syndromes (28.4%). Investigation of the relation of the current psychiatric disorders to atomic bombing exposure is now being conducted. (BBB)

**42925** CENTRAL REGULATION OF ELECTROCARDIOGRAM AND ITS RELATION TO X-RAY IRRADIATION OF THE HEAD. **Inada, Goro; Yoshimi, Osamu (Nagoya City Univ., Japan). Nagoya Med. J., 11: 145-54(Dec. 1965).**

The changes in ECG, as well as histological and body temperature changes induced by head irradiation with x rays were studied. Irradiation of the interbrain produced an elongation of the RR interval and flattening of the T wave in the ECG. These changes were believed to be due to functional disorders of the interbrain caused by x rays. As the upper center of the autonomic nerves lies in the hypothalamus, x-ray irradiation caused disorder of autonomic nerve system function resulting secondarily in changes in the ECG. Small doses of irradiation, such as 200 R, produced no histological changes in the interbrain and cerebrum, but doses of 1000−5000 R, though producing no marked change in the cerebral cortex, caused breaking down and coarse enlargement of Nissl's granules and a tendency for pyknosis of nuclei in the nerve cells of the hypothalamus. (auth)

**42926** IMPAIRED COMPLEMENTATION BETWEEN NONALLELIC MUTATIONS IN NEUROSPORA. **De Serres, Frederick J. (Oak Ridge National Lab., Tenn.). Nat. Cancer Inst. Monogr., No. 18, 33-52(1965).**

A system is described for the genetic analysis of effects, generally associated with mutations induced in diploid organisms, in the haploid organism Neurospora. The system consists of a genetically marked 2-component heterokaryon (referred to as a dikaryon) that permits the recovery and analysis of both intragenic and extragenic mutations at specific loci. Mutations induced in the dikaryon at two closely linked loci (ad-3A and ad-3B) in the ad-3 region with x ray treatment may be grouped as follows: (a) ad-$3^R$ mutations—reparable mutations that increase linearly with dose, and will grow as homokaryons on adenine-supplemented minimal medium; and (b) ad-$3^{IR}$ mutations—irreparable mutations that increase as the square of the dose and will not grow as homokaryons even on complete medium. Nonallelic complementation between pairwise combinations of ad-$3^R$ and ad-$3^{IR}$ mutations at the ad-3A and ad-3B loci has been studied by determining the linear growth rates of forced dikaryons. Such analyses have led to the following general conclusions: (a) ad-$3A^R$ + ad-$3B^R$ combinations grow at wild-type growth rate; (b) ad-$3A^{IR}$ + ad-$3B^{R}$ or ad-$3A^{R}$ + ad-$3B^{IR}$ combinations may grow at less than wild-type growth rate; and (c) ad-$3A^{IR}$ + ad-$3B^{IR}$ combinations always grow at less than wild-type rate and may grow 10 times more slowly. The reduction in the growth rates of dikaryons involving ad-$3^{IR}$ mutations has been interpreted as resulting from reduced functional activity of nonallelic loci in the immediately adjacent regions. Such behavior provides presumptive evidence for position effects in the ad-3 region of Neurospora. The extent of genetic damage associated with the inactivation of the ad-3A or ad-3B locus in the ad-$3^{IR}$ mutations can be estimated, and the extent of the functional inactivation of linked wild-type loci in the immediate vicinity of the ad-3 region can be determined by means of homology tests with genetically marked strains containing linked biochemical or morphological markers. The implications of these findings are discussed in relation to proposed studies of the mechanism of position effects at the biochemical level. (auth)

**42927** IN VITRO CELL TRANSFORMATION BY X IRRADIATION. **Borek, Carmia; Sachs, Leo (Weizmann Inst. of Science, Rehovoth, Israel). Nature, 210: 276-8 (Apr. 16, 1966).**

Experiments were undertaken to determine whether in vitro transformation of normal hamster cells can be directly induced by x irradiation, and if so, to characterize some of the conditions required for the transformation. Results showed that transformation could be induced by x irradiation in culture making it possible to transform hamster cells in vitro by a virus such as polyoma, non-viral chemical carcinogens, and x rays. The decrease in contact inhibition in x-radioinduced transformation suggested that, as in the case of transformation by polyomas and carcinogenic hydrocarbons, the change of cell surface may be responsible for the change in the regulatory mechanism of the cell. Lack of growth in agar by the x-ray transformed cells could be interpreted to suggest that the change induced in normal cells need not necessarily lead to the same final results with all three agents. (H.G.D.)

**42928** ROLES OF PHOSPHATE AND RESPIRATION IN NUCLEAR DAMAGE IN IRRADIATED RAT THYMOCYTES. **Whitefield, J. F.; Youdale, T. (EURATOM, Ispra, Italy). Nature, 211: 212-13(July 9, 1966).**

Thymocytes from one-month-old rats were suspended in a glucose-phosphate medium and exposed to 1000 R x radiation and samples were removed and placed in respirometer flasks where the oxygen consumption was measured. The cells were then prepared for microscopic examination. The relation between respiration rate and nuclear homogenization was determined by suspending irradiated cells in a phosphate medium and varying the respiration rate by incubation at temperatures varying from 25 to 37°C. The rate of nuclear homogenization was found to be very sensitive to changes in the respiration rate and when oxygen consumption fell below 8 $\mu l/10^8$ cells/hr the development of nuclear homogeneity was completely inhibited. The rate of nuclear homogenization was also found to be proportional to the phosphate content of the medium. On the basis of these cytological and biochemical observations, it was concluded that respiration and phosphate uptake proceed normally during the first hour after irradiation but the ability of the irradiated nuclei to combine inorganic phosphate with adenosine diphosphate to form adenosine triphosphate is impaired or inhibited. In addition, free phosphate is accumulated and histones are released from the irradiated desoxyribonucleoproteins of the chromatin aggregates. Variation of the respiration rate affects the post-irradiation development of nuclear changes indirectly by way of a change in the amount of phosphate which is drawn into the cell during the first hour after irradiation. (C.H.)

**42929** ELECTRIC CONDUCTIVITY AND AUTOLYSIS OF MUSCLE TISSUES IN IRRADIATED ANIMALS. **Burlakova, E. V.; Kakushkina, M. L. (Moscow State Univ.). Nauch. Dokl. Vyssh. Shkoly, Biol. Nauk, No. 3, 72-6(1965). (In Russian).**

The electrical resistance of white rat muscle (gastrocnemius, rectus abdominis) isolated the second day after 1000 R of $^{60}Co$ $\gamma$-irradiation varied from 47% higher than of that from unirradiated controls for 0.2-kc/sec current to 6% higher for 100-kc/sec current. The polarization coefficient (K = ratio of resistance at $10^4$ kc/sec to that at $10^6$ kc/sec) was higher in muscle isolated on the third day than in that on the second. Results are interpreted as due to radiation-induced physico-chemical changes in the submicroscopic structure, which are accompanied by a decrease in the number of units of low molecular weight compounds and a decrease in the number of free ions with time. The change in resistance in muscle was much less than the analogous change in liver. Autolysis proceeded slightly more slowly in the muscle of irradiated animals than in that of normal, and there appeared to be a definite correlation between resistance and autolysis. (TTT)

**42930** EFFECT OF TEMPERATURE ON RADIATION-INDUCED MALE STERILITY IN THE SILKWORM, BOMBYX MORI L. **Sugai, Etsuji (Tokyo Univ.). Nippon Oyo Dobutsu Konchu Gakkai Shi, 9: 266-70(Dec. 1965). (In Japanese).**

The effects of environmental temperature on radiation induced male sterility in the silkworm Bombyx mori are reported. Evidence was obtained that sterility induced by irradiation is influenced to a great extent by the difference of temperature after irradiation, whereas no significant effect was indicated when the temperature treatment was given before irradiation. Furthermore, it was revealed that the duration necessary for the effectiveness of the post-irradiation temperature to be clearly apparent was about 48 hrs after irradiation resulting in the highest percentage of unfertilized eggs at the high temperature (30°C), followed by those at moderate (24°C), and last by the low temperature (18°C) at which the pronounced decrease of unfertilized eggs was observed. In cytological analysis, spermatogonia were found to be most sensitive to radiation and were readily destroyed shortly after exposure. However, the radiation induced sterility in this insect was determined by the fate of spermatocytes at the time of exposure. Almost all the spermatocytes were affected by post-irradiation environmental temperatures. Death, or functionless abnormal spermatozoa occurred at high temperature and functional normal eupyrene spermatozoa were observed in the case of low temperature treatment. (auth)

**42931** ANOMALIES INDUCED BY IONIZING RADIATION ON HUMAN CHROMOSOMES. **Brancadoro, P.; Siciliano, A. (Univ., Rome). Nunt. Radiol., 31: 1217-33 (Nov. 1965). (In Italian).**

The literature on radioinduced chromosomal aberrations in man is reviewed and discussed in view of clinical data gathered primarily from leukocytes in peripheral blood cultures. Anomalies induced in chromosomes and chromatids by cancer radiotherapy, such as fragmentation, inversions, and translocations are illustrated. Mechanisms for production and maintenance of in vivo aberrations are considered. (tr-H.G.D.)

**42932** DISTRIBUTION OF $^{131}I$-LABELED INSULIN IN THE BODY OF NORMAL AND IRRADIATED RATS. **Yudenich, O. K. Probl. Endokrinol. Gormonoterap., 12: No. 4, 101-5(July-Aug. 1966). (In Russian).**

Rats were x irradiated (800 R) and $^{131}I$-labeled insulin distribution was studied 0.5, 2, 5, and 6 hours after the administration of the preparation and irradiation, and 2 hours, the 1st and 5th day after irradiation. $^{131}I$-labeled insulin distribution failed to differ from that in normal animals 0.5, 2, and 5 hours after the administration of the preparation. During the 1st and 5th postirradiation day, and 2 hours after the administration of the preparation, the radioactivity proved to be lower in the adrenal glands, thymus, and muscles of irradiated animals in comparison with that in the intact ones. On the 5th day after irradiation the liver was distinguished by a higher capacity to concentrate labeled insulin, and kidneys by a lower one. On the 5th postirradiation day the radioactivity in the spleen was higher than in controls. On the 1st and 5th postirradiation day a lower radioactivity was noted. (auth)

**42933** EFFECTS OF X RADIATION ON THE RNA OF NEOBLASTS OF POLYCELIS NIGRA DURING REGENERATION. **Boriani, G.; Ghirardelli, E.** (Univ., Bologna. Univ., Trieste, Italy). Radiobiol. Radioterap. Fis. Med., 21: 162-77(May-June 1966). (In Italian).

Two groups of specimens of Polycelis nigra were x irradiated with 1800 and 2500 R, respectively. When compared with control specimens which had not been irradiated, a slowing was observed in the regenerative processes, that was correlated with the radiation dose. Histophotometric measurements on RNA in the cytoplasm of the neoblasts of the irradiated specimens showed a noteworthy lessening of extinction values, more remarkable in those specimens which had received a higher dose. The lessening of cytoplasmatic RNA in the neoblasts was very marked in the first 20 hours after irradiation; in the following days the values tended to normalize, though always remaining below those of the control specimens. It was concluded that the lessened activity of the regenerative process may be connected to a great extent with the slackened intensity of the phenomenons of protein synthesis, which is in its turn connected with the reduced quantity of RNA in the irradiated specimens. (auth)

**42934** DYNAMICS OF LETHAL RADIATION EFFECTS IN VARIOUS BIOLOGICAL SPECIES. **Bychkovskaya, I. B.** (Central Scientific Research Inst. for Roentgen-Radiology, Leningrad). Radiobiologiya, 6: 39-45(1966). (In Russian).

A literature survey was made on the dynamics of radioinduced death of animals, with emphasis on the principles of radiation injury leading to the death of man and monkeys. The clinical picture of radiation sickness in man and monkeys after exposure to various doses of radiation is reviewed and the existence of three different pathogenetic mechanisms of radiation death is discussed. At low x radiation doses injury to the bone marrow is the principal finding, at medium doses injury to the gastrointestinal tract is the principal finding, and at high doses cerebral symptoms are manifest. Death occurred on an average on the 46th, 8th, and 2nd day after exposure of man or monkeys to the three doses of radiation. Data are also included on the life expectancy of rodents, insects, crustaceans, and infusoria after exposure to various doses of $\alpha$, $\beta$, $\gamma$, or x radiation. An analysis of data showed that certain differences in the stepwise curves were observed in exposures of various biological specimens to various types of radiations. Thus in the case of neutron irradiation of mice, no peak related to bone marrow injury has been distinctly recorded, and the response of infusoria to $\alpha$, $\beta$, $\gamma$, and x radiation was found to differ. From the evidence reviewed, it was concluded that in mammals, as well as in single-celled organisms, as the radiation dose increases the leading role in the development of radiation injuries is transferred from the more sensitive to less sensitive systems. (31 references). (C.H.)

**42935** RESTORATION OF CHICKEN THYMUS LYMPHOID TISSUE FOLLOWING WHOLE-BODY AND LOCAL IRRADIATION. **Khussar, Yu. P.** (Inst. of Experimental Medicine, Leningrad). Radiobiologiya, 6: 50-4(1966). (In Russian).

Results are reported from a comparative study of the restoration of lymphoid tissue of the thymus of three-week-old chicks after exposure to a single dose of 700 R of local x radiation or a lethal whole-body dose of 5000 R of x radiation. Systematic measurements were made of body weight, weight of the thymus, thymus lymphocyte content, number of leukocytes in the peripheral blood, protein metabolism as measured on autoradiograms using $^{35}$S-methionine as a tracer, number of cells in mitosis, and content of DNA and RNA in cells as determined by differential staining methods in tissues from animals killed from 1 to 28 days after irradiation. Results showed that after local irradiation the lymphocytes of the cortical and medullary tissues all died and restoration of their original number occurred at the expense of the lymphocytes of other organs while after acute, whole-body irradiation restoration of the thymic lymphocytes occurred by proliferation from adjacent tissue. (C.H.)

**42936** ANALYSIS OF INITIAL RADIATION EFFECTS ON CHROMOSOMES. **Sidorov, B. N.; Sokolov, N. N.; Demin, Yu. S.** (Inst. of Biophysics, Moscow). Radiobiologiya, 6: 84-7(1966). (In Russian).

Sprouts of Crepis capillaris were exposed to 400 R of x radiation and the frequency of chromosome cohesions and rearrangements in the diploid cells was studied in the anaphases using material treated with 0.1% colchicine solution and untreated material fixed from 1 to 4 hrs after irradiation. Damage in the tetraploid cells was analyzed on metaphases in preparation fixed from 14 to 17 hrs after irradiation in acetic alcohol solution. Results showed that maximum cohesions occurred from 1 to 2 hrs after irradiation, at which time the frequency of chromosome rearrangements was very low. As the frequency of cohesions decreased the frequency of rearrangements increased, while the total frequency of cells with disturbances of mitoses remained essentially unchanged. It was concluded cohesions are incomplete rearrangements and that the difference between cohesions and rearrangements is not quantitative but morphological. (C.H.)

**42937** INVESTIGATION OF THE RADIATION PROTECTION EFFECTS OF DNA, RNA, RNA HYDROLYZATE AND OROTIC ACID ON LEUKOPOIESIS IN RABBITS AND RATS. **Petrova, N. D.; Shal'nov, M. I.** Radiobiologiya, 6: 101-4(1966). (In Russian).

The effect of DNA, RNA, RNA hydrolysate, and oritic acid—administered before and after irradiation—on leukopoiesis during radiation sickness in rabbits and rats is discussed. The control and experimental rabbits were given a single dose of 550 rad; the rats were exposed to three doses: 100, 200, and 400 rad. Blood was extracted for analysis 1, 3, 7, 12, and 20 days following irradiation. The number of leukocytes in 5 ml of peripheral blood in irradiated experimental and control animals was tallied and compared. Changes in the number of leukocytes in the peripheral blood of the rabbits and rats are graphed. It is concluded that nucleinic preparations are of greater therapeutic than prophylactic benefit; while they do almost nothing to halt leukopenia, they have a beneficial effect on the restoration of leukopoiesis. It is recommended that nucleinic preparations be tested for their therapeutic effect on irradiated organisms injected with radiation protection agents which form complexes with DNA. (ATD)

**42938** EFFECT OF 5-METHOXYTRYPTAMINE AND CYSTAMINE (SEPARATELY AND IN COMBINATION) ON THE MYELOGRAM AND THE DEGENERATION OF CELLS IN THE HEMATOPOIETIC ORGANS OF IRRADIATED MICE. **Lebkova, N. P.** Radiobiologiya, 6: 105-8 (1966). (In Russian).

A study of the myelogram and of general cellular degeneration in the bone marrow, thymus, and lymph nodes of mice injected with cystamine and 5-methoxytryptamine (separately and in combination) prior to irradiation is described. White males weighing 19–20 g were used in the experiment. Five to 10 minutes before irradiation, a 0.2-ml solution of the hydrochloride salts of the preparations were injected intraperitoneally. The dosages were 150 mg of cystamine and 75 mg of 5-methoxytryptamine per kg of the animal's weight. The mice were irradiated with a dose of 700 rad (39 rad/min) and the damaged tissue studied four hours after radiation. A table presents data on pyknosis, rhexis, and lysis in the bone marrow, spleen, lymph nodes, and thymus of mice 1) not injected with either preparation prior to irradiation; 2) those receiving 5-methoxytryptamine prior to irradiation; 3) those receiving cystamine prior to irradiation; and 4) those receiving a combination of cystamine and 5-methoxytryptamine prior to exposure to irradiation. It is concluded that maximum protective effect derives from the combined dosage of cystamine and 5-methoxytryptamine. (ATD)

**42939** SINGULAR CHANGES IN PROTEIN METABOLISM DURING PARTIAL-BODY EXPOSURE TO X RADI-

ATION. **Ostashkov, K. V.; Maksimova, G. N. (Dnepropetrovsk State Medical Inst., USSR). Radiobiologiya, 6: 145-6(1966). (In Russian).**

The effects of 4 kR of x radiation on protein metabolism were studied in dogs after exposure of identical volumes of the abdomen, chest cavity, and the medullary portion of the skull. The residual nitrogen, urea nitrogen, and amino acid nitrogen in blood and total nitrogen, urea, and ammonia nitrogen in urine were determined at various times up to death at about 40 days post-irradiation. The most pronounced change was noted after irradiation of the abdominal region, when the content of residual nitrogen in the blood increased over 46% by the fifth day and remained high until death. Urea and amino acid nitrogen contents in the blood also increased by the fifth day and remained elevated. Irradiation of the chest cavity caused similar but less pronounced changes in the blood while irradiation of skull caused an initial increase in the content of protein components in the blood followed by a decrease to below the initial level by 20 days post-irradiation. The content of nitrogen components in the urine was increased soon after irradiation of the abdomen followed by a decrease 20 days later, while a less pronounced increase was noted from the fifth to the tenth day after irradiation of the skull, and irradiation of the chest cavity was followed by a rise in the nitrogenous components followed by a decrease, with a second increase noted in dogs alive on the 60th day post-irradiation. Possible reaction mechanisms involved in these responses are discussed. (C.H.)

**42940** DISTRIBUTION OF RADIOISOTOPE $^{40}$K AND INTERNAL IRRADIATION DOSE IN THE ORGANS AND TISSUES IN HUMANS AND SHEEP. **Kim, G. G. (Inst. of Pathology, Academy of Sciences, Alma-Ata, USSR). Radiobiologiya, 6: 147-6(1966). (In Russian).**

Tissues of man and sheep were analyzed for $^{40}$K content. The greatest concentration of $^{40}$K was found in muscle in both man and sheep. The radiation dose from internally deposited $^{40}$K was calculated. (C.H.)

**42941** HISTOCHEMISTRY OF PROTEIN COMPOUNDS IN THE OVARIES OF IRRADIATED RABBITS. **Lutsenko, N. M. (Kuban Medical Inst., Krasnodar). Radiobiologiya, 6: 148-9(1966). (In Russian).**

The region of the ovaries of sexually mature rabbits was exposed to 600 R of x radiation and changes in protein substances of the ovaries were studied 5 to 60 days after irradiation. Results indicated that there is a relation between radiosensitivity, microscopic structure, and protein metabolism. (C.H.)

**42942** ESTIMATION OF REACTIVITY OF SPERMATOGENIC EPITHELIUM IN MICE ON THE BASIS OF THE EXTENT OF ITS REGENERATION. **Surikova, K. K. (Inst. of Radiation Hygiene, Leningrad). Radiobiologiya, 6: 151-3(1966). (In Russian).**

A method is described for the study of the regeneration of the epithelium of the seminiferous tubles of irradiated mice that provides a convenient way to study the influence of preliminary irradiation, the effects of radioprotective agents, establishment of the RBE, and other radiobiological problems. The reaction of spermatogenic epithelium to a single dose of whole-body $\gamma$ or x radiation at doses from 200 to 600 R was studied on the 30th post-irradiation day by counting the number of cells of 4 degrees of maturity found in 50 cross sections of seminiferous tubules examined on a center slice of the testes. At this time the wave of spermatogenesis that began at the time of irradiation is ending, and the numerous direct and indirect effects of irradiation are reflected in the picture of the seminiferous tubules. At the radiation doses used the spermatogenic epithelium of the seminiferous tubules undergoes active regeneration, and definite groups of germ cells representing derivatives of the spermatogonia of various generations are present in many tubules 30 days after exposure. The absence of early spermatogonia means that regeneration has not begun while the presence of early spermatogonia, spermatocytes, spermatids, and spermatozoa in the tubules means that the process of regeneration is proceeding. (C.H.)

**42943** EFFECTS OF EXTERNAL $\alpha$-IRRADIATION DOSE ON THE INTENSITY OF GROWTH OF CELLS IN VITRO. Mikhailova, A. A.; Popov, A. S.; Sekamova, E. N. Radiobiologiya, 6: 153-4(1966). (In Russian).

Animal cells in monolayer cultures grown on slants were exposed to $\alpha$ particles from a Pu source for 24 hr or to $^{60}$Co $\gamma$ radiation at doses from 18 to 900 rad. On the 4th post-irradiation day the number of viable cells was counted and compared with that of controls. The criterion of radiation injury was the decrease of growth of cells. Analysis of experimental results led to the conclusion that the number of cells in a monolayer culture depends on inactivation of the irradiated cells, retardation of mitoses, and number of divisions before death, and each of these effects are vulnerable to $\alpha$ and $\gamma$ radiation to different degrees. (C.H.)

**42944** SERUM LYSOZYME IN ANIMALS SUBJECTED TO WHOLE-BODY X IRRADIATION. **Kofler, Emilio; Pruzzi, Maria Carla; Goi, Anna (Univ., Milan). Rendic. Ist. Lombardo Sci. Lett., B96: 243-8(1962). (In Italian).**

Experiments were conducted in rats and rabbits on the variation of serum lysozyme activity after large doses of x rays. It is suggested that a depletion in serum lysozyme in irradiated animals might be related to their marked susceptibility to infection. In the first series of experiments, adult female rats were exposed to a 1000-R, whole body dose of 180-kv x rays and serum lysozyme activity was measured 24 hr later. Although there was considerable individual variation, the activity was about one-third as high in irradiated as control rats. In other experiments, rats received 650 R and serum lysozyme activity was measured on the first, second, third, and sixth day postirradiation. By the first day the activity had fallen to ~7.5 $\mu$g/ml, where it remained through the sixth day, compared to a control level of ~17 $\mu$g/ml. In a third series of experiments, adult rabbits were given a single 300-R dose of x rays and blood samples were taken daily. From a control level of 20 $\mu$g/ml, the serum activity rose on the first day postirradiation to about 37 $\mu$g/ml, then declined sharply to reach a min value on the fourth day of 7 $\mu$g/ml. It gradually rose again to normal by the 9th day. (BBB)

**42945** THE RESPONSE OF THE BROWN SPOTS CHARACTER OF DROSOPHILA MELANOGASTER TO TREATMENT WITH X RAYS. **Zambruni, Laura (Univ., Milan). Rendic. Ist. Lombardo Sci. Lett., B97: 3-18 (1963). (In Italian).**

Larvae, pupae, and adults of the two stocks carrying the brown spots character (bsp) of Drosophila melanogaster (wild Aspra 52 and a stock derived from this, isogenic for the 2nd chromosome) were irradiated. The data reported demonstrate clearly that the character under examination is sensitive to ionizing radiation during the whole period of development of the individual, from the young larva to the newly emerged adult. In the isogenic stock, x rays caused a decrease in the frequency of the character manifestation in the individual treated as larvae. In the pupae, on the other hand, no particular effect was noted. In adults, 24 hr after emergence from the pupal case, irradiation caused an increase in the frequency of the spots. In the wild stock a response was obtained that was similar to that observed in the isogenic one, but was more marked. The decrease obtained both in the larvae and in the pupae was much more marked, as was the increase in the adults. A complex mechanism, therefore, appears to govern the manifestation of the bsp character. As to its nature, it was possible to formulate several hypotheses, among which the present data do not allow any preference. The action of x rays, however, both in larval and pupal stage, seems to tend to inhibit the spots, presumably as a consequence of the damage caused to the whole organism and in particular to undifferentiated cells. In the adult stage, however, the action of radiation seems to facilitate the production of the spots, probably on the basis of an increase in enzymatic activities. (BBB)

**42946** EVOLUTION OF EXOPHTHALMOS ASSOCIATED WITH HYPERTHYROIDISM TREATED WITH RADIOIODINE. **Neto, Geraldo A. de Medeiros. Rev. Ass. Med. Brasil., 9: 132-3(Apr. 1963). (In Portuguese).**

The relation of exophthalmos to the radioiodine treatment of hyperthyroidism is discussed, with an examination of the conflicting evidence from different clinics using different doses of radioiodine. It was not possible to find any significant correlation between the presence of exophthalmos and the incidence of myxedema developed during the treatment of several patients by radioiodine. It is concluded that development of exophthalmos associated with hyperthyroidism treated with radioiodine does not differ significantly from ophthalmopathy in thyrotoxic cases treated by other means. (BBB)

**42947** EVALUATION OF PROCEDURES USED IN RECENT STUDIES ON INDUCED RESISTANCE AGAINST SCHISTOSOMIASIS IN MICE. Perlowagora-Szumlewicz, Alina. Rev. Inst. Med. Trop. Sao Paulo, 7: 317-22(Nov.-Dec. 1965).

Results are reported from a study on the effects of experimental modifications thought to enhance antibody formation against S. mansoni. The effects of a large number of cercariae exposed to a relatively low x radiation dose on the course of an otherwise lethal infection were followed in mice. The results indicate clearly that preinfection with large numbers of irradiated cercariae had an opposite effect to that hoped for in that it increased the worm population in the portal system and the liver egg accumulation in the host. The uniformity and consistency of this apparently paradoxical reaction indicated that this was not a fortuitous result but, rather, a meaningful facet of the host response to the presence of relatively large numbers of worms from the irradiated cercariae, thus leaving little doubt that an aborted infection with irradiated cercariae is a potential menace to the safety of the host. (auth)

**42948** A CYTOCHEMICAL AND CYTOSPECTROPHOTOMETRIC STUDY OF LEUKOCYTES IN $^{32}$P INTERNALLY IRRADIATED RATS. USE OF SOME VITAMINS AS RADIOPROTECTORS. Turcu, Gr. (Inst. of Medicine and Pharmacy, Bucharest). Rev. Roum. Physiol., 3: 145-59(1966).

Cytochemical and cytospectrophotometric assays of leukocytes in $^{32}$P internally irradiated rats were carried out. The rats were given in their diet either vitamin C, or a water soluble vitamin complex. The results show that vitamins have no effect on the number of leukocytes in the blood stream. They influence, however, the quality of granulocytes and lymphocytes, namely the granulocytes appearing in the blood stream during irradiation have an increased phosphatase activity; a cytospectrophotometric assay shows the quality of the lymphocyte nucleus is different from that of the normal nucleus. (auth)

**42949** EFFECT OF BETA RADIATION FROM RADIOSULFUR ($^{35}$S) ON GROWTH BEHAVIOR IN RICE. Basu, A. K. (Bose Inst., Calcutta). Sci. Cult. (Calcutta), 32: 241-2(May 1966).

Rice seeds of the varieties Rupsail, Latisail and Patnai were beta-irradiated by soaking for 48 hr in a 0.22 or a 2.20 μC sulfur-35 solution. Controls were soaked in distilled water. Plants from seeds undergoing each treatment were studied weekly for growth characteristics. Latisail was least affected by beta radiation; Rupsail growth was suppressed relative to the dose; and Patnai growth was suppressed at the higher dose, but enhanced at the lower one. The differential radiosensitivity may be attributed to differences in size and shape of seeds and thickness of seed coat among the varieties. (C.O.)

**42950** THE EFFECT OF RADIATION ON THE SPERMATOZOA. III. ON THE VIABILITY OF BOVINE SPERMATOZOA BY γ-RAY IRRADIATION. Tanaka, Ryoichi; Matsumoto, Takuya (and others). Sci. Rept. Fac. Agr. Ibaraki Univ., No. 12, 53-9(Feb. 1965). (In Japanese).

The effects of γ rays from 10 kC or 16 kC $^{60}$Co sources on dilute suspension of bull semen were studied. The conditions of irradiation were a single dose ranging from $1.1 \times 10^5$ R to $1.5 \times 10^5$ R at 60 minutes exposure time. The survival rate of bull spermatozoa was unaffected in the suspension using irradiated diluent (Seminan). It is concluded that decreased survival rates of spermatozoa may be based not on effect of diluent components but on damage of spermatozoa. It was assumed that the dosage which resulted in immobility of spermazoa 6 hours after irradiation is above $5.0 \times 10^5$ R. There was no immediate influence on the morphology of bull spermatozoa observed after exposure to doses ranging from $1.1 \times 10^5$ R to $5.5 \times 10^5$ R. (auth)

**42951** CHROMOSOME ABERRATIONS: INCREASED INCIDENCE IN BONE MARROW OF CONTINUOUSLY IRRADIATED RATS. **Chlebovsky, Ondrej (Dept. of Biology, Kosice, Czech.); Praslicka, Milan; Horak, Jindrich. Science, 153: 195-6(July 8, 1966).**

The number of chromosomal aberrations in the bone marrow of continuously irradiated rats temporarily decreases after exposure, and then increases as the total dose and time after irradiation increase. This increase in aberrations is greater than that expected as a result of age alone. (auth)

**42952** $^{210}$Pb AND $^{210}$Po IN TISSUES OF CIGARETTE SMOKERS. Holtzman, Richard B.; Ilcewicz, Frank H. (Argonne National Lab., Ill.). Science, 153: 1259-60 (Sept. 9, 1966).

Concentrations of lead-210 and polonium-210 in rib bones taken from 13 cigarette smokers were about twice those in six nonsmokers, the polonium-210 being close to radioactive equilibrium with the lead-210. In alveolar lung tissue the concentration of lead-210 in smokers was about twice that in nonsmokers. These differences are attributed to additional intake by inhalation of lead-210. (auth)

**42953** CHANGES OF THE DAILY RHYTHM OF MITOSIS IN PINUS NIGRA ARN. CAUSED BY GAMMA RAYS. Bevilacqua, B. (Forestry Faculty, Zagreb). Silvae Genet., 14: 81-7(May-June 1965).

The diurnal rhythm of mitosis was studied in root tips of Pinus nigra seedlings that had germinated from γ-irradiated and control seeds. The total number of all mitotic stages examined during 24 hrs decreased considerably and were dose-dependent. Three maxima of mitotic frequency were observed in control material during a 24-hr period. Comparison of irradiated material with the controls showed a radioinduced disturbance of the time sequence of mitotic frequency that was also dose dependent. Increased doses of γ rays produced a shift from the three maxima observed in the controls to one long period of maximum mitotic activity at 5000 R doses. The time of occurrence of the maxima was also found to be affected by irradiation. (H.G.D.)

**42954** RADIATION INACTIVATION OF FOOT AND MOUTH DISEASE VIRUS. Massa, D. (Ministry of Health, Rome). pp 159-71 of STI-DOC-10/54.

Descriptions are presented of several diseases of animals caused by viruses, the effects upon the animals by the disease, and the losses suffered in infected herds. The importance of the control of these viral diseases in international commerce by quarantine regulations on items such as meat, milk, blood, hides, hair, wool, bone, animal feeds, and packaging materials, is pointed out. Such information is followed by a detailed description of the experiments carried out to inactivate the Foot and Mouth Disease virus by heat and by irradiation, in both the liquid and dry states. It is indicated that the inactivation by irradiation requires 3 Mrad in the liquid state but that 4 Mrad are required if in the dry state. There is a short discussion on the need for similar researches with the other types of animal viruses and on some of the difficulties encountered in carrying out this type of work. (auth)

**42955** EARLY REACTIONS OF THE PERIPHERAL BLOOD AND THE BONE MARROW AFTER LETHAL WHOLE-BODY IRRADIATION. PART I. **Loehr, Eberhard (Univ., Marburg, Ger.). Strahlentherapie, 130: 245-64(June 1966). (In German).**

The effects of an exchange transfusion made during whole-body irradiation of female rats on the cellular constituents of the peripheral blood and the hemoglobin content of erythrocytes was investigated for lethal radiation doses. Possibility of the extension of the life span by this treatment was also investigated. The exchange blood obtained during the irradiation was studied biochemically. The results showed that in the peripheral blood after a whole-body x irradiation of 780 R no radio-induced inhibition of the enzymatic activity was detected in the enzymes investigated: hexokinase, glycerinaldehyde-3-phosphate-dehydrogenase, glucose-6-phosphate-dehydrogenase, and glutathion-reductase. The altered substrate concentrations of the investigated adenine-nucleotide must be interpreted as a probably reversable perturbation of the energy metabolism. In contrast to the studies of previous workers, no reduction of the ATP concentration was detected in the peripheral blood after whole-body irradiation when this concentration is related to an equal number of cells. The alterations of the redox buffer system GSSG/GSH were less traceable to the radioinduced oxidation processes than to the modifications of the total concentration on the bases of the radioinduced permeability disturbances of the erythrocytes. These investigations showed that after lethal whole-body irradiation in the dose range from 780 and 1500 R no incisive disturbance of the energy metabolism in erythrocytes is biochemically detectable. (J.S.R.)

**42956** THE EFFECTIVENESS OF BONE MARROW TRANSPLANTATION IN REPEATED IRRADIATION OF RATS WITH LETHAL DOSES. Zographov, Dimiter G.; Baev, Ilia A. (Forschungsinstitut fuer Radiologie und Strahlenhygiene, Sofia). Strahlentherapie, 130: 370-5 (July 1966). (In German).

The authors inquired into the efficiency of bone marrow transplantations in ''Wistar'' rats who had undergone X-ray irradiation with a LD 95/30 and were exposed to the same dose on the 22nd day after the first irradiation. They found that transplantation still kept its therapeutical effect ($p < 0.001$), though reduced from 70 down to 38 per cent ($p = 0.025$). Findings are discussed in the light of the knowledge of the bone marrow state on the 22nd day after irradiation, of the course of hemopoietic regeneration as well as of the various mechanisms of acute radiation death. (tr-auth)

**42957** EFFECTS OF VARIOUS RADIATION DOSES ON THE ERYTHROPOIES OF RATS. Travnicek, Tomas; Neuwirt, Jan; Taborsky, Jan; Stoklasova, Hana (Karls-Univ., Prague). Strahlentherapie, 130: 376-90(July 1966). (In German).

Accumulation of $^{59}$Fe in the bone marrow of rats as well as a minimum incorporation and utilization 48 hours after irradiation with high doses might be the cause for inhibiting the transfer of erythropoietic elements from the marrow into the blood stream. The low marrow activity on the 4th day after irradiation with 800 or 1000 R suggests a complete blockage of the blood production during this period of time. The dose dependent increase in $^{59}$Fe accumulation in liver and intestine was observed to be proportional to the extent of marrow damage and decrease in utilization and incorporation as well. Changes in weight and activity of the spleen also are dose dependent. (tr-auth)

**42958** EFFECTS OF IONIZING RADIATION ON ULTRAMICROSCOPIC STRUCTURE OF PHOTORECEPTORS. Klug, Herbert; Lommatzsch, Peter; Hemke, Stefanie (Univ., Berlin). Strahlentherapie, 130: 391-406(July 1966). (In German).

The photoreceptors of rabbit retina were investigated by electron microscopy 2 and 24 hours and 3 and 7 days after X-irradiation of the head with 10,000 R. Morphological changes could be detected in the outer layers of the retina and the nuclei (outer granular cells) 2 hours after irradiation. Dilatation of the interlamellar spaces and an increased density of the two polar accumulations of chromatin were observed. Destruction of the outer layers and pyknotic changes of the nuclei were found 24 hours after irradiation. With some rare exceptions (cone cells?), also the inner layers were extensively deformed; all of the mitochondria had a circular shape with an inner structure still well maintained. After 3 days, the outer layers were mostly destroyed and formed myelin-like structures. The mitochondria were mostly greatly swollen and degenerated. The nuclei exhibited a dense and uniform chromatin mass. After 7 days there were only a few pyknotic nuclei left. (tr-auth)

**42959** RADIATION SENSITIVITY OF RATS IN A STATE OF HYPERTHERMIA. Braun, Heribert; Hornung, Guenter (Univ., Wuerzburg, Ger.). Strahlentherapie, 130: 407-12(July 1966). (In German).

The influence of total body X-irradiation on hyperthermia produced by infrared irradiation in rats was investigated. An increased radiosensitivity, expressed as a decrease in survival time, was observed in animals whose metabolism was increased during irradiation. (tr-auth)

**42960** MUCOPROTEIN URINE IN RADIATION INJURIES. PART I. D'Addabbo, Angelo; Viterbo, Francesco; Fanfani, Gilberto (Univ., Bari, Italy). Strahlentherapie, 130: 426-31(July 1966). (In German).

Whole-body exposure to 800 R of x rays in rats caused an increase urinary mucoprotein excretion. The highest mucoprotein values occurred contemporaneously with the highest mortality rate. In animals irradiated with sublethal doses, the mucoprotein levels were found to be correlated with the irradiation dose. The increased urinary mucoprotein excretion was considered as an expression of the radiation-induced ''general and nonspecific mesenchyme reaction'' in response to radiation injury. (auth)

**42961** EFFECT OF LOCAL IRRADIATION OF THE HEAD OF RATS IN THE INFANTILE PERIOD ON SPERMATOGENESIS. Savkovic, Nada; Kacaki, J.; Andjus, R.; Malcic, K. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). Strahlentherapie, 130: 432-6(July 1966).

Data are presented concerning the abscopal effect of local irradiation of heads of infantile male rats on their subsequent fertility, sperm morphology, and histologic changes of testes. It is shown that local irradiation of heads diminishes the fertility rate of the animals as well as the percentage of normal sperm and causes severe histological changes in testes of some of them. (auth)

**42962** EFFECTS OF X RADIATION ON THE GROWTH OF YOSHIDA ASCITES SARCOMA IN WHITE RATS. Stutz, Ernst (Univ., Freiburg i. B.). Strahlentherapie, 130: 440-8(July 1966). (In German).

X-irradiation of rats facilitated the growth of intravenously injected Yoshida-Ascites-sarcoma. The effect was dose dependent. The most frequent occurrence of metastases was observed when irradiation was done 4 days prior to injection. Almost no liver metastases were observed in non-irradiated animals; in irradiated animals the frequency of liver metastases was proportional to the dose. Most of the liver metastases were found when irradiation was done 1 day prior to injection of the sarcoma. The occurrence of liver metastases was more frequent in male than in female animals. Irradiation of the abdomen was less effective than total body irradiation in regard to all the effects mentioned. A significant effect could not be observed when irradiation was done with lead protection of the abdomen. (tr-auth)

**42963** MODEL STUDIES ON THE QUESTION OF METASTASES OF IRRADIATED MALIGNANT TUMORS. Berger, Hans Ekkehard (Univ., Goettingen, Ger.). Strahlentherapie, 130: 544-56(Aug. 1966). (In German).

HeLa cell cultures were subjected to trypsin and a procedure of aspiration and expulsion with a syringe. The resulting suspension of free cells was irradiated (by electron beams from a betatron). Standardized morphological criteria were used to obtain a curve that represents the sum of spontaneous and radiation induced loosening with respect to the border areas of colonies. This curve shows the percentage of cells that seem to have loosened themselves from the colony structure. Multiplication of the loosening and the rate of take represents the total number of viable cells ready to move or to be moved from their primary site. As far as the findings in cell cultures are applicable to the treatment of humans, they suggest that at least the first fraction in a therapeutic series of irradiations should be large, say 2 to 4 times that of the following doses, if the plan otherwise calls for steps of 300 R or the equivalent thereof. (auth)

**42964** REACTION OF RAT INTESTINES TO PARASYMPATHOMIMETIC SUBSTANCES DURING THE RADI-

ATION SYNDROME. Danysz, Andrzej; Polocki, Boleslaw; Szaykowski, Andrzej (Medizinische Akademie, Bialystok, Poland). Strahlentherapie, 130: 579-85(Aug. 1966). (In German).

Experiments in rats revealed, that the intestine showed an increased reactivity towards parasympathomimetic substances (acetylcholine, pilocarpine, prostigmine) in vivo as well as in vitro during the radiation syndrome. Concomitantly, the acetylcholine level in the intestine as well as the acetylcholine esterase activity in the intestine, brain, and liver is increased. The catecholamine content of the adrenal medulla decreases after a temporary increase. (auth)

**42965** LEUKOCYTE COUNT AS CRITERIUM OF TOXICITY FROM COMBINED USE OF IONIZING RADIATION AND CYTOSTATIC SUBSTANCES. Fleischmann, Ewald; Karrer, Karl (Univ., Vienna. Oesterreichische Krebsforschungsinstitut, Vienna). Strahlentherapie, 130: 586-9(Aug. 1966). (In German).

The effect of the time sequence of a simple whole-body x-irradiation with 100 R and a single intraperitoneal administration of 50 mg/kg of Endoxan was investigated in rats. The leukocyte count in the peripheral blood was used as the criterium for the combined toxicity. From the response of the leukocyte counts it might be concluded that the leukocyte values are indicative for the total toxicity. (auth)

**42966** REACTIVATION AT LOW TEMPERATURE OF SABIN POLIOVIRUSES INACTIVATED BY X-RAYS. Cajal, N.; Baba, C.; Botis, S.; Babos, A.; Danielescu, G.; Oprescu, E. Stud. Cercet. Inframicrobiol., 16: 293-301 (1965). (In Rumanian).

Attenuated varieties of polioviruses (Sabin strains) inactivated by x-rays may, in exceptional cases, recover activity after a 3–13 month interval, at –15°C. Reactivation is more frequent in type III. This phenomenon is due to the reversibility of the modifications induced by x-rays on viral RNA associated with reactivation by multiplicity. The genetic characteristics of the reactivated viruses allow us to regard them as mutants. (auth)

**42967** EFFECTS OF INTERNALLY DEPOSITED RADIONUCLIDES ON THE ORAL TISSUES OF SOME EXPERIMENTAL ANIMALS. Nakayama, Hideo (Tohoku Univ., Sendai). Tohoku Igaku Zasshi, 71: 43-80(Feb. 1965). (In Japanese).

When radioactive Ce, P, and Sr were given subcutaneously to kittens, rats, and mice, higher radioactivity was found in permanent tooth buds than in milk teeth in kittens. The incisors in mature rats and mice showed higher accumulated dose than in molars. This high dose of accumulation was associated with rapid growth of incisors. Accumulated dose of $^{90}$Sr was estimated to range from 1000 to 10,000 rads, and $^{32}$P from 100 to 1000 rads. In bone tissues $^{90}$Sr showed higher dose of accumulation than $^{32}$P. In femur and mandible dose was not significantly different. Salivary glands took up more $^{32}$P than $^{90}$Sr, and parotid glands had higher radioactivity than submandibular glands. When $^{90}$Sr and $^{32}$P were administered separately, the relative specific activity taken up by femur was not parallel with the dose administered. Pyknosis, atrophy, and cellular destruction were observed in organs where radionuclides were deposited. These changes lead to secondary damages such as hypoplasia of enamel and dentine, paraplasia of dentine, pulp atrophy, necrosis of gingiva, damage to hematopoietic tissues in bone marrow, and degeneration of salivary glands. The most predominant finding was the production of osteodentine in growing apical area of incisors. First sign of atrophic changes of odontoblasts was observed after an accumulated dose of 900 rads in incisor and about 300 rads in molar and it became manifest at the dose of 6400 rads in incisor and 1400 rads in molar. Atrophy of pulp cells occurred at the dose of 1100 rads in incisor and 700 rads in molar. The damage of bone marrow in the femur observed at the dose of 500 rads. Hypoplasia, gelatinous changes, and dysplasia of epiphyseal cartilage area in the bone marrow occurred at 1000 rads and aplasia of the bone marrow was the major finding when dose reached 2000 rads. (auth)

**42968** EFFECTS OF X-IRRADIATION ON THE DEVELOPMENT OF ASCARIDIA GALLI, INTESTINAL WORM OF CHICKENS. Ruff, M. D.; Hansen, M. F.; Ostlind, D. A. (Kansas State Univ., Manhattan). Trans. Kan. Acad. Sci., 68: 498-507(1965).

At doses exceeding 5000 R, x irradiation of Ascaridia galli eggs before cleavage retarded development and increased mortality of the eggs. A peak of increased infectivity occurred among the worms recovered from birds inoculated orally with eggs given 5000 R prior to segmentation. The number of worms recovered from birds inoculated with eggs irradiated after larvation decreased at doses of 5000 R and at 20,000 to 80,000 R. There was no significant influence of irradiation on growth rate of worms developing from eggs irradiated before segmentation. Irradiation of eggs after larvation at levels of 5000 to 20,000 R significantly stimulated growth of worms (20 days postinfection) as compared with the controls. Higher irradiation doses (40,000 to 80,000 R) significantly decreased growth rate (20 days postinfection) as compared with the lower irradiation doses. By the 35th day postinfection, the nonirradiated control worms had attained a size comparable to those receiving 5000–20,000 R. Irradiation appeared not to influence the length of the esophagus, tail, or spicules. Only immature worms were recovered from birds infected with eggs exposed to 20,000 or 40,000 R after larvation. Mature worms developing from eggs exposed to 5000 or 10,000 R after larvation were all females. Irradiation of unsegmented eggs did not affect sex of the worms. (BBB)

**42969** ON THE INFLUENCE OF BETA RADIATION ON THE DEVELOPMENT IN MICE OF CANCER OF THE SKIN INDUCED BY 9,10-DIMETHYL-1,2-BENZANTHRACENE (DMBA). Kim, V. Kh. Vestn. Akad. Med. Nauk. SSSR, 19: 36-41(1964). (In Russian).

Experiments were conducted on $2\frac{1}{2}$- to 3-month-old female mice weighing 19 to 21 g. After removal of the hair on the back, to a section of skin 1.5 × 1.0 cm a 0.05% solution of 9,10-dimethyl-1,2-benzanthracene (DMBA) was applied and the animals were irradiated (3750 erg/cm$^2$). Another group of mice received a weaker application (0.01%) of DMBA and were irradiated 24 hours later. This procedure was continued once a week for 21 weeks. Repeated exposures to doses of $\beta$ radiation ($^{144}$Ce–$^{144}$Pr) which in themselves did not cause tumors, intensified the carcinogenic effect of DMBA applied to the skin. This potentiation increased as the radiation dose was augmented. Preliminary single-dose, partial-body x irradiation (650 R) noticeably slowed down the appearance and development of tumors of the skin induced by repeated applications of DMBA (0.05%). However, this effect proved to be inconsistent with x irradiation. When the concentration of DMBA was decreased to 0.01%, the results were more constant. Sarcoma rather than cancers appeared in a few mice. This was apparently caused by the change in the reactivity of the connective tissue of the skin under the influence of radiation. (BBB)

**42970** DEPENDENCE OF THE SOMATIC MUTATION SPECTRUM OF EPHESTIA KUEHNIELLA ON THE DEVELOPMENT STAGE OF THE IRRADIATED ANIMAL. Mueller, Ilse; Pentz, S.; Harte, C. (Univ., Cologne). Z. Verebungsl., 97: 353-60(1966). (In German).

Experiments were conducted to determine whether the developmental stage at irradiation affected the sensitivity pattern for mutant types in Ephestia. Dose effect curves were established for pupae of two age groups corresponding to the stages that were attained by preirradiation treatments at low and high temperatures. Moth pupae were exposed to 100, 200, 400, 600, 800, or 1000 R doses of x rays. The exponent of the dose effect curves was the same for all mutant types and independent of the age at irradiation. Age groups differed in their mutational spectra. Results are discussed with regard to a possible difference in the specific radiosensitivity of epithelial cells and scale stem cells. (H.G.D.)

**42971** RADIATION EFFECTS UPON GASTROINTESTINAL ABSORPTION OF WATER IN THE RAT. Rohwer, Paul S.; Noonan, Thomas R. 9p. (CONF-660212–4). ORAU. Gmelin, AED-CONF-66-016-3.

From Radiation Research Society, 14th Annual Meeting, Coronado, Calif.

Results are reported from a study on the effects of 750 R whole-body x irradiation on gastrointestinal absorption of tritiated water in rats. An impairment of absorption was noted that reached a maximum on the third post-irradiation day and was followed by rapid recovery with normal absorption restored by the fourth post-irradiation day. (C.H.)

**42972** IN VIVO INTESTINAL ABSORPTION OF L-ALANINE IN IRRADIATED RABBITS. Mehran, A. R.; Blais, R. (Laval Univ., Quebec). 18p. (CONF-650560-14). ORAU.

From 13th Annual Meeting of the Radiation Research Society, Philadelphia.

The effects of ionizing radiation ($^{60}$Co) on intestinal absorption of L-alanine were studied by means of an in vivo technique permitting measurement of radioactivity in a large number of blood samples taken from the portal and femoral veins of albino rabbits following duodenal injection of 20 $\mu$C of L-alanine-$^{14}$C. The experiments were carried out four days after irradiation. The curves so obtained show a very rapid rise and fall of activity in the portal vein under all three experimental conditions (control, 300 R, and 600 R). Absorption was practically completed fifty minutes after the injection of this amino acid. Absorption trends were closely similar and no significant difference was observed between those of irradiated and unirradiated animals. At the doses used, histological examination four days after irradiation revealed slight effects on the absorbing cells of the intestine. (auth)

**42973** VOLATILE COMPOUNDS INDUCED BY IRRADIATION IN BASIC FOOD SUBSTANCES. Merritt, Charles Jr.; Angelini, Pio (Army Natick Labs., Mass.). 28p. (CONF-650902-21). ORAU. Gmelin, AED-CONF-65-235-35.

From American Chemical Society, 150th National Meeting, Atlantic City.

It was assumed that undesirable odors and flavors in irradiated meat are due to volatile compounds produced in the meat. The mechanism of formation of these compounds was studied in the following meats: haddock, beef, veal, mutton, lamb, and pork. The total volatile constituents are composed of about 90% alkanes, alkenes, and olefin compounds. These hydrocarbons come from lipids in meat. Other compounds derived from lipids are alcohols, carbonyl compounds, aldehydes, and ketones. Irradiation of dry oxygen-free lipids results in formation of n-alkanes, n-alkenes, and traces of n-alkynes. Sterols give normal- and iso-alkanes from cleavage of the alkyl side chain. Sulfur compounds and aromatic compounds are also found in irradiated meats. Substances employed for radiation studies were beef fat, butter fat, triglycerides, fatty acid esters, beef protein, oxytocin, amino acids, cholesterol, and beef lipoprotein. A series of alkanes and isoalkanes was isolated from irradiated cholesterol. Benzene, toluene, and sulfur compounds are the major components in volatiles produced in irradiated haddock. Sulfur compounds and aromatic hydrocarbons are formed in the protein fraction; aliphatic hydrocarbons are formed from the lipid. The lipoprotein fraction produced both aliphatic hydrocarbons and sulfur compounds. Only the lipoprotein produced radiation off-odor. The major product of amino acid irradiation is carbon dioxide; other products are sulfur dioxide, hydrogen sulfide, carbonyl sulfide, dimethyl sulfide, and methyl mercaptan. (H.L.W.)

**42974** CHANGES IN THE RELATIVE BIOLOGICAL EFFECTIVENESS (RBE) OF A 35-Mev ELECTRON BEAM AS A FUNCTION OF TISSUE DEPTH. Schwarz, George; Berg, Roger; Botstein, Charles (Montefiore Hospital and Medical Center, New York). 4p. (CONF-660212-7). ORAU. Gmelin, AED-CONF-66-016-7.

From Radiation Research Society, 14th Annual Meeting, Coronado, Calif.

The calculated increase in LET from 7.4 kev/u in the plateau region to 30 kev/u in the terminal portion of a 14-Mev electron beam reported by Haynes and Dolphin was verified experimentally in ten-week-old CF$_1$ mice given whole-body doses from 600 to 1500 rads with the 35-Mev electron beam of a Brown-Boveri betatron at various depths in a lucite phantom. Death rates were recorded and isoeffect doses compared. The LD 50/30 was identical to the 100% (maximum) and 60% dose levels. At the 12% level, however, the LD 50/30 was reduced by a factor of 1.48, and the slope of the dose–response curve was steeper than at other levels. (H.G.D.)

**42975** RESPONSE OF ISOLATED LEUKOCYTE LYSOSOMES TO GAMMA IRRADIATION. Harris, John W. (Australian Atomic Energy Commission Research Establishment, Sutherland, New South Wales). 24p. (CONF-660212-5). ORAU. Gmelin, AED-CONF-66-016-4.

From Radiation Research Society, 14th Annual Meeting, Coronado, Calif.

Lysosomes isolated from rabbit polymorphonuclear leukocytes were irradiated in vitro at 0 to 4°C with 1 to 50 krads of $\gamma$ radiation and subsequently incubated for 1 hour at 0 to 4, 28, or 37°C. Irradiation of lysosome suspensions resulted in a rapid drop in their optical density (520 m$\mu$). The rate at which this fall occurred during the first 15 minutes post-irradiation was dose-dependent. The magnitude of the decrease in turbidity resulting from irradiation was less during incubation at 0 to 4°C than at higher temperatures; at all temperatures the effect showed a tendency to level off during the latter portion of the incubation period. Irradiated lysosome suspensions had increased amounts of protein in the granule-free suspending medium. At high doses this effect was greater, relative to controls, at 0 to 4° than at higher incubation temperatures. It was concluded that radiation may have produced some form of damage in or near the membrane of the isolated lysosome and that subsequent stress (in the form of heating) resulted in an exaggerated response (fall in optical density). The leakage of protein, on the other hand, occurred in the absence of such extreme stress and may represent a more sensitive indication of lysosomal damage. The possible relationship of these data to the role of the lysosome in the initiation or exacerbation of cellular radiation damage was discussed. (auth)

**42976** EFFECTS OF IRRADIATION (EXTERNAL AND INTERNAL) ON LYMPHATIC DYNAMICS. Ariel, Irving M.; Resnick, Michael I.; Oropez, Ruben (New York Medical Coll., New York). 17p. (CONF-660433-4). ORAU. Gmelin, AED-CONF-66-064-5.

From American Radium Society, 48th Annual Meeting, Phoenix, Ariz.

Modifications of lymphatic dynamics resulting from lymph system irradiation were investigated in 30 patients exposed either externally or internally. Lymphographic studies were made on the lymphatic vessels and lymph nodes to determine the effects of orthovoltage and supervoltage radiations and of intra-lymphatically administered radioisotopes. Of the 10 patients who received external irradiation, none manifested any alteration in lymphatic dynamics. Either $^{131}$I-labeled Ethiodol or microspheres of $^{198}$Au or $^{90}$Y were employed for internal irradiation. In the 20 patients on whom lymphographic studies were performed after the endolymphatic administration of radioisotopes, very little, if any effect was observed on the lymphatic vessels and the dynamics of lymph flow; however, a marked effect on the lymph nodes was noted. Alterations in lymphatic dynamics that occur after surgery are discussed. (H.G.D.)

## Radiation Effects Therapy and Countermeasures

**42977** (ORO-2669-2) PROGRESS REPORT [ON RECOVERY FROM X-RADIATION DAMAGE IN TRADESCANTIA PALUDOSA], DECEMBER 1965–DECEMBER 1966. Beatty, Alvin V. (Emory Univ., Atlanta, Ga.). Sept. 15, 1966. Contract AT(40-1)-2669. 7p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Repair of x-radioinduced chromosomal aberrations by nucleic acids was studied in the first microspore division of Tradescantia paludosa. All irradiation was given in a helium atmosphere with a total dose of 400 R administered at 50 R/min. Experimental results published during the report period demonstrated that exogenous ATP does enter the microspore cells. Material treated with the purine and pyrimidine bases of the nucleic acids showed little if any reduction in aberration yield, the greatest effect being caused by thymine. Adenosine had no effect on aberration yield in x-irradiated microspores, while guanosine, cytidine, and uridine reduced aberration yield by approximately 25%. The greatest reductions in yield after treatment with triphosphates were produced by ATP and CTP. Except for deoxythymidine deoxy-compounds reduced aberration yield by about 50%, as did adenosine-3′,5′-diphosphate. The role of the biosynthetic pathway of deoxyadenosine in furnishing energy for aberration repair was investigated. (H.G.D.)

**42978** MICROCIRCULATORY EFFECT OF SEROTONIN ON HEMOSTASIS FOLLOWING WHOLE-BODY X-IRRADIATION. Kivy-Rosenberg, Evelyn; Zweifach, Benjamin W. (New York Univ.). Contract AT(30-1)-1680. Amer. J. Physiol., 211: 730-4(Sept. 1966).

The terminal vascular bed of the mesentery was examined in rats following exposure to relatively high doses of whole-body x irradiation. The mesocecum was exteriorized (under anesthesia) at selected intervals between 3–30 days postirradiation. Vascular reactivity and the status of the blood-tissue barrier were examined in conjunction with evidence for a hemostatic defect per se. Results indicate a sustained response to epinephrine. The hemostatic defect could be counteracted by repeated serotonin injections starting on day 3 or 5 postirradiation; but a defect in the venular and capillary wall as demonstrated by topical application of Versene still remained. Neither intravascular thrombus formation following local injury, nor in vitro clotting time in both treated and untreated rats were correlated with platelet numbers. (auth)

**42979** RADIOPROTECTIVE PROPERTIES OF THE COMPOUNDS 1-PHENYL-4,5(D-GLUCOPYRANYL)-IMIDAZOLINE-2-THIONE AND 1-p-ETHOXYPHENYL-4-D-ARABINYLTETRAHYDROXYBUTYLIMIDAZOLINE-2-THIONE. Alvarez, V.; Astudillo, M. D.; Ramos, E.; Sanz, F.; Zumel, C. L. An. Real Soc. Espan. Fis. Quim. (Madrid), Ser. B, 62: 729-36(June 1966). (In Spanish).

Two imidazole derivatives were studied as chemical protective agents and their activity proved in three biological patterns: at the molecular level, in hemin, at the cellular level, in yeast (Saccharomyces cerevisiae), and at the supercellular level, in mice. These compounds show higher radioprotective activity during the second stage of lesions caused by radiation, that is, during the hematic stage, and the protective mechanism is quite similar to that of nucleotides, blood regeneration stimulators as hepatic protective agents. Their protective activity is lower at supercellular level than cellular and molecular levels, probably because of their rapid metabolism. (auth)

**42980** RADIOPROTECTION IN TOTAL-BODY-IRRADIATED PRIMATES. Byron, J. W.; Lajtha, L. G. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Brit. J. Radiol., 39: 283-5(May 1966).

The mortality of monkeys exposed to a potentially lethal dose of whole-body x radiation was significantly reduced by treatment with antibiotics, TAB, and a single transfusion of allogeneic platelets. Omitting antibiotic therapy gave results that were inferior to those obtained when antibiotics were used in combination with TAB and platelets. The survival figure is comparable with that for lethally irradiated monkeys treated with autogeneic bone marrow. (auth)

**42981** THERAPEUTIC EFFICACY OF BONE MARROW IN IRRADIATION WITH HIGH-ENERGY PROTONS. Zaretskaya, Yu. M. Byull. Eksp. Biol. Med., 61: No. 6, 38-9(June 1966). (In Russian).

It was shown that in irradiation of CBA mice with high-energy protons (240 Mev, 950 ± 50 rad) an injection of isologous cells of bone marrow in a dose of several million produces a considerable therapeutic effect that is especially pronounced (survival rate of up to 90 per cent) if transfusion was performed within 24 hours of exposure. (auth)

**42982** BLOOD PICTURE FEATURES IN ANIMALS PROTECTED BY CYSTEINAMINE FROM IONIZING RADIATION. Strelkov, R. B.; Topchiyan, L. M. (Inst. of Experimental Pathology and Therapy, Sukhumi, USSR). Farmakol. Toksikol., 28: 558-61(1965). (In Russian).

Bacq's hypothesis on the mechanism of 2-aminoethanethiol radioprotective action as a stimulator for the section in the blood of histamine and histamine-like substances was tested experimentally. Blood samples were taken from intestinal tissues of protected and control guinea pigs. No changes were observed in the concentrations of histamine and histamine-like substances. It is concluded that Bacq's hypothesis cannot be confirmed experimentally. (H.G.D.)

**42983** RADIATION PROTECTIVE EFFECTS OF LOCAL ADMINISTERED CYSTEAMINE. RADIATION PROTECTIVE EFFECTS ON RADIATION REACTION OF THE MUCOUS MEMBRANE OF THE RECTUM, IN MICE. Fujimoto, Tatsuro (Kyushy Univ., Japan). Fukuoka Igaku Zasshi, 56: 930-44(Oct. 1965). (In Japanese).

Local injection of cysteamine, which showed outstanding radiation protective effects in screening tests, markedly reduced the inhibiting effect of x rays on the growth of Ehrlich tumor implanted subcutaneously. The protective effect was also noted for x-ray induced epilation of d·d strain mice. Marked hyperemia, increased mucous secretion, was observed in the mucous membrane of the rectum of 2000-R locally irradiated mice. Intrarectal infusion of cysteamine, total dose 6–7 mg/mice (300 mg/Kg body weight) revealed marked protective action to this mucous membrane reaction, both microscopically and macroscopically. This suggests the possibility of rectal mucous membrane protection in the radiation therapy of uterine cervic cancer. (TSS)

**42984** IN VITRO STUDIES ON RADIATION LYMPHOID RECOVERY OF MOUSE SPLEEN. Globerson, Amiela (Univ. of Wisconsin, Madison). J. Exp. Med., 123: 25-32(Jan. 1, 1966).

Experiments were designed to test: whether the thymus has any direct stimulatory effect on lymphoid regeneration of the spleen: whether cell migration to the spleen is essential for lymphoid regeneration; and what function might be played by bone marrow or lymph nodes in lymphoid regeneration. C3H/He/Au mice were used as donors. Spleen and thymus were taken from 2- to 3-month-old mice, and bone marrow from 3- to 6-week-old mice. X irradiation was performed at 140 kvp to a 550-R total-body dose. The results showed that singly isolated spleen explants were incapable of lymphoid regeneration and that thymus had no stimulatory effect on spleen regeneration. Bone marrow interacted synergistically with spleen leading to appearance of lymphoid cells that were not detected in singly isolated bone marrow or spleen. No stimulation of lymphopoiesis in bone marrow was conferred by thymus in the absence of spleen. Thus, a synergistic interaction between irradiated spleen and normal bone marrow was seen, indicating that bone marrow lymphoid cells are specifically stimulated in the presence of irradiated spleen and that in return the spleen gains such cells. Singly isolated bone marrow or spleen are not lymphoid under the same experimental conditions. That this is probably a result of specific interaction between the tissues is indicated by the observation that irradiated thymus did not confer such an effect on bone marrow, nor did the spleen gain lymphocytes from normal thymus or lymph node. (BBB)

**42985** RADIOBIOLOGICAL EFFECTS IN ANIMALS AFTER THE PRELIMINARY ACTION OF ACCELERATION. Davydov, B. I.; Antipov, V. V.; Konnova, N. I.; Saksonov, P. P. Kosm. Issled., 3: 789-95(Sept.-Oct. 1965). (In Russian).

The following indices of the combined effect on the animal organism of acceleration and irradiation were examined: survival percentage, the reaction of radiosensitive organs (spleen and thymus), and some blood component levels. Male white mice were centrifuged (8 to 10 g for 15 to 30 min) 30 min, 4 hr, and 1 day prior to irradiation with $^{60}$Co $\gamma$ rays in a dose of 700 rad or 660-Mev protons in a dose of 1300 rad. Experimental results showed that under the combined influence of acceleration and irradiation, the $DL_{50/30}$ was approximately 100 rad higher than with irradiation only. However, the average lifetime of the animals that died during the 30-day period after irradiation (with a dose of 750 rad) was shortened by previous acceleration. Statistically reliable differences were not observed in the average weights of the spleen and thymus of animals centrifuged and then irradiated. Radiation leukopenia with acceleration and ionizing radiation effects combined was less severe than with radiation alone. Several possible mechanisms of the modifying effect of acceleration on radiation injury are discussed. Severity of radiation injury appeared to be dependent on the time interval between acceleration and irradiation. (ATD)

**42986** EFFECT OF SOME SPACE-FLIGHT FACTORS ON THE HEREDITARY STRUCTURES OF MAMMALS. **Arsen'eva, M. A.; Belyaeva, L. A.; Demin, Yu. S.; Pokrovskaya, G. L.; Golovkina, A. V.; Gavrilina, L. I. Kosm. Issled., 3: 796-807(Sept.-Oct. 1965). (In Russian).**

The effect on certain mammalian structures (bone marrow, spleen, and testes) of vibration and acceleration is studied, as independent factors and in combination with radiation. In the first series of experiments, mice were subjected to vibration with a frequency of 35 and 75 cps (amplitude 0.4 mm) for 15 min, 1 hr, and 4 hr. Experimental results showed an increase in the frequency of chromosome adhesions and an increased frequency of chromosome rearrangements in bone-marrow cells and spleen, together with adhesion of chromosomes in the metaphase of meiosis of testes cells. In the second series of experiments, mice were subjected to acceleration of 8 g for 5 and 15 min. This factor caused an increase in the frequency of chromosome adhesions, and some increase in the number of chromosome rearrangements and chromosome fragmentations in the bone-marrow cells of mice. In general, it was found that vibration and acceleration cause disruptions in the nuclei of bone-marrow and spleen cells. Another group of experiments on the combined effect of vibration or acceleration and radiation on the cell nucleus showed a general decrease in the radiation effect. Either of these factors, when applied prior to irradiation with x rays (33 rad/min) or fast neutrons (11 rad/min), decreased the radiation effect by decreasing the frequency of chromosome aberrations in bone-marrow cells by the second day after irradiation and the frequency of chromosome aberrations in germ cells after 24 hr. However, the protective effect of vibration and acceleration depends not only on when the effect was exerted (prior to or after irradiation), but also on the time interval between the influence of these factors and subsequent irradiation. (ATD)

**42987** DECREASED RADIATION MORTALITY IN DOGS TREATED WITH TYPHOID-PARATYPHOID VACCINE. **Ainsworth, E. J.; Mitchell, F. A. (Naval Radiological Defense Lab., San Francisco). Nature, 210: 321-3(Apr. 16, 1966).**

The radioprotective effects of typhoid-paratyphoid vaccine (TAB) were investigated in dogs injected intravenously with TAB either 24 hrs before or 1 hr after x irradiation. Intravenously administered TAB produced vomiting, diarrhea, and fever within 2 hrs and killed 6% of the animals within 48 hrs. By 12 hrs normal body temperatures were reached, and most signs of acute toxicity had passed. The injection of TAB 24 hrs before exposure to 360 rads reduced mortality to 13% as compared with 60% among saline-injected controls. Mortality in animals given TAB 1 hr after irradiation was 50%, a reduction that was not statistically significant. The mechanism by which TAB protects, and the mechanism by which endotoxin effects such marked changes in the number of circulating granulocytes and platelets is not known. (H.G.D.)

**42988** INFLUENCE OF AMINOETHYLISOTHIOURONIUM BROMIDE-HYDROBROMIDE AND HYPOXIA ON RECOVERY FROM RADIATION INJURY IN MICE. **Ainsworth, E. J.; Phillips, T. L.; Kendall, K. (Naval Radiological Defense Lab., San Francisco). Nature, 210: 323-4(Apr. 16, 1966).**

Studies were conducted with AET and hypoxia to determine the influence of protectants on initial x-ray injury and recovery from this injury in mice. A split-dose technique was used wherein the animals were first given a conditioning radiation dose and afterwards divided into groups and exposed to graded challenge doses for the determination of the $LD_{50/30}$ at different times after the conditioning dose. In experiments with AET using CF1 mice, the agent was administered intraperitoneally prior to the first exposure, and administration was not repeated prior to challenging doses. In the hypoxia studies with $LAF_1$ mice both the conditioning and challenging doses were given under hypoxic conditions. Data indicated that mice protected by AET or hypoxia show a greater sensitivity to a second exposure than would be expected on the basis of the protection ratios determined from acute lethality studies. Recovery was impaired when radiation injury was sustained in the presense of AET or hypoxia. (H.G.D.)

**42989** PREVENTION OF NUCLEAR DAMAGE IN IRRADIATED RAT THYMOCYTES BY POST-IRRADIATION OXYGEN DEPRIVATION. **Whitfield, J. F.; Brohee, H. (EURATOM, Ispra, Italy). Nature, 211: 775-6(Aug. 13, 1966).**

Experiments were conducted to show that the radioinduced loss of nuclear structure in rat thymocytes may be prevented by maintenance of aerobically irradiated cells in an anaerobic environment. Rates of radioinduced nuclear change were studied in thymocytes from living and dead animals that had been x-irradiated (1000 R). On the bases of cytological and biochemical observations the post-irradiation loss of nuclear structure in thymocytes was attributed to a phosphate-induced separation of histones from the DNA of the interphase chromatin. Such a separation would cause the highly condensed nucleoproteins of the chromatin granules and threads of the interphase nucleus to disaggregate into a structureless basophilic mass. The striking difference between the rates of radioinduced nuclear changes in living and dead animals was probably due to the absence of respiration in the anaerobic environment. (H.G.D.)

**42990** CHEMICAL PROTECTION OF IRRADIATED SKIN (HISTOLOGICAL ASPECTS). **Boccardi, S.; Morano, E. (National Inst. for the Study and Treatment of Tumors, Milan. Hospital Maggiore, Vercelli, Italy). Panminerva Med., 6: 362-5(Oct. 1964).**

The behavior of irradiated skin with and without chemical protection by sub-dermal application of cysteamine was investigated in guinea pigs. After a single high dose of ionizing radiation, the skin was analyzed histologically. The cysteamine-treated animals showed far less thickening of the epithelial layer, and in general the lesions were far less extensive than in the non-treated animals. (TCO)

**42991** RADIOPROTECTIVE ACTION OF IPRONIAZID. **Mitts, Paul; Friess, Richard; Looby, Thomas; Wayne, Ralph (Univ. of South Dakota, Vermillion). Proc. S. Dak. Acad. Sci., 43(22): 142-4(1964).**

Mice were injected with monoamine oxidase inhibitors $6\frac{1}{2}$ to $8\frac{1}{2}$ hrs prior to administration of 800 R x-ray doses. The radioprotective effectiveness of serotonin in 75 mg/kg doses was compared to that of iproniazid in 75 and 150 mg/kg doses. Protection was measured by survival time. Results suggested that iproniazid is at least equal to serotonin in its radioprotective ability. (H.G.D.)

**42992** ACTION OF RADIATION PROTECTION AGENTS DURING FRACTIONAL IRRADIATION. III. EVALUATION OF THE EFFECTIVENESS OF VACCINE PROPHYLAXIS DURING PROLONGED IRRADIATION. **Alekseeva, O. G.; Lavrenchik, E. I.; Yarmonenko, S. P. (Inst. of Labor Hygiene and Occupational Diseases, Moscow). Radiobiologiya, 6: 112-14(1966). (In Russian).**

Vaccines and chemical protectors were tested on white mice in order to determine their protective effect against x-ray and gamma irradiation. The experiments were performed on 1300 white male mice weighing 20–23 g. The RUM-11 machine was used for the x-ray irradiation. Its parameters are as follows: 180 kw, 15 ma, filters: 0.5-mm Cu and 1-mm Al, dosage 40 rad/min, distance from anticathode: 35 cm. The GUBE-800 machine was used for $^{60}$Co gamma irradiation. It was found that yeast lysates injected intraperitoneally in mice 2 weeks prior to exposure to an 800-rad dose of gamma irradiation had no protective effect and, when injected immediately after irradiation, even shortened the life of the mice. BTsZh vaccine was injected intraperitoneally (1 mg per mouse) 2 weeks before exposure to irradiation; the vaccine was not found to change the degree of radiation sickness. Injections of the chemical protectors, sodium aminoethylthiophosphate and aminoethylisothiuronium, were found to be effective; the survival rate was 52% and 59% higher than in the control animals. Both preparations were injected intraperitoneally (7 mg per mouse) 10–15 minutes prior to irradiation. Tables showing survival rates for mice injected with the vaccines and chemical protectors (separately and in combination) and for one-time and repeated irradiation are given. (auth)

**42993** PRESUMPTIVE RADIOPROTECTIVE ACTION OF LYSOZYME. **Kofler, Emilio; Baldoli, Emildoli (Univ., Milan). Rendic. Ist. Lombardo Sci. Lett., B96: 97-101(1962). (In Italian).**

Kofler has previously observed that whole-body irradiation results in a marked depletion of serum lysozyme levels, and it was suggested that the postirradiation infections of the intestine in heavily irradiated animals might be promoted by this depletion of lysozyme (as well as by a depletion of antibodies and other immune factors, and injury to intestinal mucosa). The question of whether lysozyme administered to irradiated animals would have a protective effect was investigated. Adult female rats were given whole-body doses (700 R) of 180-kv x rays and intramuscular injections of lysozyme (150 mg/kg) according to various schedules before and/or after irradiation. The control rats all died by the 8th to 10th day after irradiation. No effect of lysozyme was seen on survival time or fall in body weight. In a second series of experiments the dose of radiation was reduced to 650 R and the dose of lysozyme increased to 250 mg/kg; it was injected intraperitoneally instead of intramuscularly. Similar results were obtained in this series, no effect of lysozyme being noted in mortality rate or body weight changes. (BBB)

**42994** ORIGIN AND TREATMENT OF RADIOGENIC DIARRHEA. **Kleibel, Franz (Univ., Heidelberg). Strahlentherapie, 130: 334-9(July 1966). (In German).**

As many authors have reported, Mexaform S has a regulating bacteriostatic and bacteriotoxic effect in cases of different specific and non-specific, acute and chronic disturbances of the intestine with dysbiosis; almost no effect on the physiological flora of the intestine was observed. Mexaform S was used in 87 patients with radiation induced enterocolitis and a further therapeutic aspect of the drug was discovered. In 76% of the cases treated, it was an effective combination drug. The acute radiogenic inflammations of the intestine could be healed and complicating chronic thickening of the tissue could be avoided in time. Due to the normalizing effect on the intestinal flora and the regulating influence on the intestinal function, the radiation therapy of the abdominal tumors could be continued and finished without interruption. This meant a subjective and objective improvement in the symptoms of the patients. The water-electrolyte-metabolism could be normalized by curing the diarrhea. (tr-auth)

**42995** MITIGATION OF SECONDARY DISEASE IN MICE RECEIVING BONE MARROW FROM DONORS PRETREATED WITH CORTISONE AND ALKYLATING AGENTS. **Ambrus, C. M.; Ambrus, J. L.; Feltz, E. T. (Roswell Park Memorial Inst., Buffalo. State Univ. of New York, Buffalo). Transplantation, 4: 245-9(May 1966).**

Transplantation of homologous bone marrow of mice following supralethal doses of whole-body irradiation was followed by a high incidence of death due to late disease presumably resulting from the production of antibodies against the host by immunologically competent elements of the transplanted bone marrow. The incidence of secondary disease was somewhat lower if the bone marrow donors were pretreated with cortisone, nitrogen mustard, or both. Such pretreatment decreased the number of lymphocytes in the bone marrow and reduced the levels of circulating $\gamma$-globulin. Treatment of the recipients with cortisone subsequent to bone marrow transplantation had little effect. (auth)

**42996** RECOVERY FROM RADIATION INJURY IN SHEEP, SWINE, AND DOGS AS EVALUATED BY THE SPLIT-DOSE TECHNIQUE. **Reviews and Lectures No. 162. Page, N. P.; Nachtwey, D. S.; Leong, G. F.; Ainsworth, E. J.; Alpen, E. L. (Naval Radiological Defense Lab., San Francisco, Calif.). 11p. (CONF-650560-12). ORAU. Gmelin, AED-CONF-65-157-24.**

**From 13th Annual Meeting of the Radiation Research Society, Philadelphia.**

Recovery from radiation injury is being studied at this laboratory in several species of animals. The split-dose technique is employed using two-thirds of the $LD_{50/30}$ for 1 Mvp x-rays as the conditioning dose. Recovery of sheep is characterized by several distinct phases. At first, recovery is slow with only 20% occurring by 11 days. The second phase is very rapid with considerable over-recovery or radioresistance (150%) at 20 days. However, at 30 and 45 days the sheep are again sensitive showing 65% recovery. Duroc swine recover more rapidly than sheep showing 48% recovery at 3 days, complete recovery at 7 days and a significant over-recovery (188%) at 20 days. This over-recovery is still observed at 61 and 107 days. Recovery in sheep and swine is complex and is not adequately described by a single exponential function. In contrast, the recovery pattern of mongrel dogs may be an exponential with a recovery half time of 3 days. (auth)

# Radiation Hazards and Protection

## *See also* HEALTH AND SAFETY

*Refer also to abstract 43421.*

**42997** (ANL-7136, pp 191-204) RADIATION PROTECTION. **(Argonne National Lab., Ill.).**

Progress is reported on the development of new approaches to the therapy of poisoning by radioactive and nonradioactive metals. Emphasis was placed on the development and use of complexing agents capable of forming soluble complexes with tissue-bound toxic metals to enhance excretion and the use of drugs to alter normal physiological processes to promote increased metal excretion. Data are included from studies in mice and rats on the metabolism of Pu, the carcinogenicity of $\alpha$ particles from Pu in bone and liver, and the effects of diethylenetriaminepentaacetic acid (DTPA) on the excretion of Pu. The distribution of polymeric Pu in bone and reticuloendothelial (RES) tissues of mice, before and after RES stimulation or depression, was studied. The biochemical basis for the transformation of cartilage to bone was investigated using calf scapula cartilage. Studies on amoeba showed that the site of lethal nitrogen mustard damage within the cell is different from the site of damage induced by x radiation. Possible reaction mechanisms involved are discussed. Amoeba nuclei in freshly prepared homogenates were found to be extremely sensitive indicators of toxicity and methods for the culture of amoeba to preserve the normal structure of the nuclei are described. The protective actions of cysteine and 2-mercaptoethylamine (MEA) when given intravenously or orally dissolved in water or in a gum arabic solution before or after exposure of mice to 775 R whole-body x radiation were studied in an effort to establish the locus of protection of orally administered aminothiols. (C.H.)

**42998** (EUR-2992.f) RADIOPROTECTEURS CHIMIQUES. **Rapport Final 1.4.1964–31.12.1965. (Chemical Radioprotective Agents. Final Report, April 1, 1964–December 31, 1965). (Liege Univ. (Belgium). Laboratoires de Radiobiologie). 1966. 30p. Dep. mn.**

Results are summarized from studies on the pharmacology and biochemical effects of certain radioprotective agents on the entire animal and on selected tissues of mice and rats. The radioprotective compounds studied included cysteine, cystamine, cysteamine, cyanide, diethyldithiocarbamate, 5-hydroxytryptamine, and hypothermia. A thorough study was made on the reactions of mouse skin to x radiation and the effects of cysteine and cysteamine on skin radiosensitivity. The effects of the protective agents on growth of Ehrlich tumor, humoral immunity, and reactions to skin grafting were also studied. Cysteamine per os did not protect the mouse against continuous exposure to a $^{137}$Cs $\gamma$ source. The fresh water algae Nitella flexilis was found to be a suitable organism for use in certain radiobiological research. (C.H.)

**42999** (NP-15934) RADIOSTRONTIUM IN WET MILK, TAP WATER, AND RAIN WATER. Pinto, E. P.; Tavares Coelho, M. C. (Minas Gerais Univ., Belo Horizonte (Brazil). Instituto de Pesquisas Radioativas). 1960. 15p. Dep. mn.

In English and Portuguese.

Data are presented on the $^{90}$Sr content in milk samples collected in Belo Horizonte, Brazil, in 1958. The values for radioactivity due to $^{90}$Sr in milk were very small and lower than the maximum permissible dose for industrial areas and civil populations. (C.H.)

**43000** ESTIMATION OF INTERNAL CONTAMINATIONS WITH URANIUM FROM URINE EXCRETION RATES. Pusch, W. M. Atomkernenergie, 11: 404-13(1966). (In German).

Previously published data on human urine excretion of uranium are compared and two mean curves for these rates are plotted. It is concluded that the maximum permissible contamination should be different for single intakes, such as that caused by accidents, than for chronic exposures. Using urine content to estimate the body burden caused by a single intake, it would be necessary to know the time of intake exactly. This is because of the very rapid decrease in the excretion rate in the period immediately after contamination. If internal contamination is detected in a routine sample assay, it is usually impossible to fix the time of intake. (C.O.)

**43001** TOTAL BETA AND ALPHA ACTIVITY LEVELS IN ORGANIC SUBSTANCES. AREA OF THE ANDUJAR URANIUM INSTALLATION. Alvarez Ramis, Concepcion. Energ. Nucl. (Madrid), 10: 147-58(Mar.-Apr. 1966). (In Spanish).

Results obtained in the measurement of the total $\alpha$ and $\beta$ activity in a large number of biological samples collected between 1959 and 1963 near the Andujar uranium installation are reported. The sampling techniques are described and the location of the sampling stations is given. The results obtained are tabulated. (J.S.R.)

**43002** COMPARATIVE RADIATION PROTECTION BY MERCAPTOALKYLAMINES AND INDOLYLALKYLAMINES AGAINST GAMMA RAYS AND PROTON BEAMS AT 660 AND 120 Mev. Shashkov, V. S.; Saksonov, P. P.; Antipov, V. V.; Razgovorov, B. L.; Morozov, V. S.; Murin, G. F. Farmakol. Toksikol., 28: 350-1(1965). (In Russian).

Cystamine, aminoethylisothiuronium, serotonin, and 5-methoxytryptamine protected from destruction 50–80% of mice, with 100% lethality among controls and augmented the average life span of the animals which died as a result of gamma- and 660–120 Mev proton irradiation. The protective effect of tryptamine and of 5-oxytryptophan proved much below these figures. (auth)

**43003** MECHANISM OF ANTIRADIATION ACTION BY MERCAMINE. Chernenko, G. T. Farmakol. Toksikol., 28: 475-7(1965). (In Russian).

Tests staged on rats demonstrated the bactericidal activity of blood serum in healthy animals to decline during the first 3 hours following injection of mercamine (100 mg/kg intraperitoneally). An injection of mercamine before irradiation (at a dosage level of 800 R) attenuates the extent of the bactericidal activity of the blood serum in rats in the course of infection. (tr-auth)

**43004** PROBLEM OF USING RADIOPROTECTIVE PHARMACOLOGICAL AGENTS UNDER SPACEFLIGHT CONDITIONS. Davydov, B. L; Antipov, V. V.; Kozlov, V. A.; Saksonov, P. P.; Shashkov, V. S. Kosm. Issled., 4: 482-91(May-June 1966).

In tests on mice (exposed three times to 44.4 G, 1.4 G/sec accelerations, with 5 min per exposure and 5 min between exposures on a centrifuge with a 4.25 m arm length) and guinea pigs (exposed twice to 22.0 G, 0.7 G/sec with 5 min between exposures), lowered resistance to acceleration was noted after injections of cystamine (80 to 150 mg/kg), AET (15 to 150 mg/kg), 5-methoxytryptamine (75 mg/kg), serotonin (50 mg/kg), and aminazine (1 to 10 mg/kg). A change in resistance after injections of phenatine (2 to 10 mg/kg) and strychnine (0.05 mg/kg) was insignificant. Thirty min after the combined injection of phenatine (5 to 10 mg), strychnine (0.5 to 1.0 mg), and aminazine (2.5 mg), the EKG's and respiration of dogs exposed to 6 to 8 G (0.2 to 0.3 G/sec) did not differ from those of control centrifuged animals. It was concluded that extreme caution should be exercised in recommending radioprotectors, especially AET, cystamine, and 5-methoxytryptamine, for use on spaceflights. (ATD)

**43005** NATURAL LEVELS OF $^{210}$Pb, $^{210}$Po AND $^{226}$Ra IN HUMANS AND BIOTA OF THE ARCTIC. Holtzman, Richard B. (Argonne National Lab., Ill.). Nature, 210: 1094-7(June 11, 1966).

A study of natural fallout of the airborne nuclides $^{210}$Pb, $^{210}$Po, and $^{226}$Ra in specimens of the human food chain from the arctic region was reported. For comparison some related plant materials from non-arctic regions were included. Results of the activities were tabled in lichens, horsetails, rumen, grass, reindeer, caribou, lamb, sheep, and human placenta. (D.H.M.)

**43006** $^{90}$Sr IN FINNISH AND SOME IMPORTED CEREALS DURING THE HARVEST PERIOD 1963–64. Rajama, J.; Nikkilae, O. E.; Maekelae, P. (State Inst. for Technical Research, Helsinki). Nature, 211: 213-14 (July 9, 1966).

Milk and cereals provide the major part of the Ca, and consequently of the $^{90}$Sr, in the Finnish diet, with milk contributing 87% and cereals 6%. However, the ratio of $^{90}$Sr/Ca is much greater in cereals than in milk. Samples of wheat and rye from the 1963 harvest and samples of cereals imported during the winter of 1963 and 1964 were analyzed for $^{90}$Sr content in both grain and flour. The content of $^{90}$Sr in Finnish cereals was much higher than that in imported products. When the levels of activity in Finnish harvests of 1963 were compared with those of Denmark and West Germany they were found to be similar. It was concluded that the difference in $^{90}$Sr content in domestic and imported cereals was due to a difference in the time of harvesting. (C.H.)

**43007** RADIOPROTECTIVE ACTION OF INERT GASES AND LOW MOLECULAR NARCOTICS. V. PROTECTIVE EFFECT OF LOWER MONOATOMIC ALCOHOLS IN X IRRADIATION OF BEAN SEEDLINGS. Paribok, V. P.; Genter, E. I. (Inst. of Cytology, Leningrad). Radiobiologiya, 6: 97-100(1966). (In Russian).

Five day old Vicia faba bean seedlings of the Russkiy chernyy variety were immersed for two hours in alcohol solutions and irradiated in air, in nitrogen, or in nitric oxide diluted in nitrogen in order to compare the protective effect of alcohols with that of compressed gases. The specimens were irradiated by a RUM-11 device in hermetically sealed glass containers which were filled with a given gas. The dosage was from 50 to 800 rad (51 rad/min) and the filter was 3-mm Al + 5-mm glass (container wall); focusing distance was 60 cm. Inhibition in the growth of the main root was taken as the indicator of irradiation damage. Of the alcohols tested (methyl, ethyl, propyl, and butyl), methyl alcohol was found to have the greatest protective effect. The protective effect vanished when the alcohol was washed off the seedlings prior to irradiation, and no protective effect was observed when the seedlings were immersed in alcohol following irradiation. In the case of ethyl alcohol, the protective effect was less for specimens irradiated in nitrogen while for methyl alcohol the protective effect vanished completely. The protective effect of the alcohols remained for the case of irradiation in the presence of pure oxygen. It is concluded that the protective effect of alcohols cannot be ascribed to a lowering in oxygen content in the cell as a result of stepped-up expenditure of oxygen in the oxidation of the alcohols, and that the radiation protection mechanisms of alcohols and inert gases under pressure are dissimilar. Data on the protective effect of various concentrations of $CH_3OH$, $C_2H_5OH$, $C_3H_7OH$, and $C_4H_9OH$ in air and in nitrogen are presented in tabular form. While the mechanism underlying the protective mechanism of alcohols is not clear, it may involve an adsorption blocking of the radiosensitive structures in the cells which retards the radiosensitizing action of oxygen. (ATD)

**43008** CONCENTRATION OF OXYGEN IN TISSUES DURING BARBAMYL ANESTHESIA. **Strelkov, R. B.; Vorob'ev, O. Ya. Radiobiologiya, 6: 109-11(1966). (In Russia).**

The effect of barbamyl (sodium amytal) on the $O_2$ concentration in the spleen, liver, and brain of white rats was investigated by the polarographic method. The experiments were performed on 45 white male rats weighing between 185 and 240 g. A 0.2-mm platinum electrode (the cathode) was inserted directly into the tissues of the organ under investigation, and a silver chloride electrode (the anode) was fastened to the tail of the animal. A 75-mg/kg dose of barbamyl was injected intraperitoneally. When, at the end of the experiment, the animals were killed, the oxygen content in the spleen dropped sharply. Data on $O_2$ changes in the spleen of white rats receiving protective dosages of barbamyl and serotonin are presented in tabular form. Barbamyl brought about an increase in oxygen content in the spleen while serotonin significantly reduced it. Barbamyl had virtually no impact on oxygen content in liver and brain tissue. Data on the anti-irradiation effect of barbamyl (75 mg/kg) are presented in a table. The data show that 13.3% (4 out of 30) of the experimental animals survived 30 days following exposure to 850 rad of gamma irradiation. It is concluded that barbamyl's protective action is independent of the "oxygen effect" in spleen tissue. It is suggested that the protective effect is a result of barbamyl's effect on the central nervous system. (ATD)

**43009** RADIATION PROTECTION EFFECT OF APILAC IN AN EXPERIMENT ON ANIMALS. **Arbuzov, S. Ya.; Novoselova, G. S.; Frolov, S. F.; Shmuskovich, N. N. (Military Medical Academy, Leningrad). Radiobiologiya, 6: 149-50(1966). (In Russian).**

The radiation protection effect of apilac (a substance secreted by bees) was studied in experiments on white mice, white rats, and rabbits. The animals were subjected to x rays in lethal and sublethal doses (700−800 rad). Apilac was injected intraperitoneally in the mice and subcutaneously in the rats and rabbits in doses described as nontoxic for animals and humans alike. The effectiveness of apilac was measured in terms of survival, weight, mean longevity, clinical course of radiation sickness, quantitative changes in peripheral blood, and the relative weight of the animals surviving the irradiation. It was found that a single injection of apilac had no protective effect. When apilac was injected prior to and seven days after irradiation, the number of survivors was higher. On the 30th day after irradiation, 40% of the mice treated with apilac were still alive while the untreated control group had all perished. Sixty percent of the mice treated with cystamine were still alive during the same time span. A combination of cystamine and apilac was found to be less effective than apilac alone. Complete data on the effect of apilac, cystamine, and a combination of the two on mice, rats, and rabbits are presented in tabular form. It is concluded that apilac has a pronounced protective effect on mice, rats, and rabbits that have been exposed to lethal and sublethal x-ray doses. (ATD)

**43010** EFFECT OF pH OF SOLUTION ON THE CONTAMINABILITY BY RADIOISOTOPES TO THE SKIN. **Tashiro, S.; Wadachi, Y.; Muramatsu, M. (Japan Atomic Energy Research Inst., Tokyo. Tokyo Metropolitan Univ.). Radioisotopes (Tokyo), 15: 224-7(1966).**

The effect of acidity of soiling solution on the contaminability to a pig skin for $^{35}$S, $^{204}$Tl, $^{125}$Sb, $^{147}$Pm, and $^{210}$Po at a given soiling time is described. It was found that the contaminability to the skin increased with increasing pH for a cationic radioisotope such as thallium and with decreasing pH for an anionic one such as sulfur, and that the radioactive contaminations with antimony, promethium, and polonium depended on their dissolved states which were effected specifically by the acidity of the soiling solutions. (auth)

**43011** OZONE CONCENTRATIONS IN UV IRRADIATION ROOMS. **Hartwig, Manfred; Eschke, Wilhelm; Zirwer, Dietrich (Physikalisch-Technische Institut, Deutsche Akademie der Wissenschaften, Berlin). Strahlentherapie, 130: 451-8(July 1966). (In German).**

Concentrations of ozone produced in rooms where UV-irradiations were done, were determined by using an optical method. The ozone values measured were, in general, considerably above the maximum permissible concentration of the room air. The ozone concentrations produced are determined by the type of source and space conditions. (tr-auth)

## Radiotherapy and Radiodiagnosis

*Refer also to abstracts 42796, 43390, and 43616.*

**43012** (BMWF-FBK-66-03) UNTERSUCHUNGEN ZUR HERABSETZUNG DER STRAHLENBELASTUNG. I. TEILBERICHT: SCHUTZ GEGEN ROENTGEN- UND ELEKTRONENNEBENSTRAHLUNG. **(Investigations on the Reduction of Radiation Burden of a Patient Treated by High-Energy Radiation. Part I: Protection Against Secondary X-Rays and Scattered Electrons). Wuerthner, K. (Rudolf-Virchow-Krankenhaus, Berlin (West Germany). Abteilung fuer Strahlungsphysik). Mar. 1966. 29p.** Dep. mn.

The level of scattered radiation from the 35-Mev-BBC-Betatron is found to lie in general below 0.25°/00 of the effective x-radiation. For an effective dose rate of 100 R/min this value is only a little above the value of 1000 mR/h which is required for conventional x-ray machines above 150 kv nominal voltage. Therefore, radiation protection of the patient approximates that for conventional machines. The quality of total secondary radiation in a phantom exposed to electrons shows that the gonadal dose is reduced to about 10% by commercial 1 mm Pb scrotum caps. It is shown that because of good radiation protection within the machine the thickness of concrete walls in the secondary radiation region may be relatively small. (auth)

**43013** (ORO-2459-1) EFFECT OF RADIATION ON TRANSPLANTATION IMMUNITY. **Progress Report, July 1, 1965–July 1, 1966. (Medical Coll. of Virginia, Richmond. Dept. of Surgery). Contract AT(40-1)-2459. 9p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.**

Progress is reported on studies of various aspects of the effect of radiation on transplantation immunity. Yttrium-90 (80 mC) was implanted in the abdominal aorta of dogs and the serum protein levels were determined at various times after isotope implantation. The effects of the immunosuppressive drugs Azathioprine (Imuran) or prednisone in combination with intraarterial implants of $^{90}$Y on the survival of renal homografts were studied in dogs. Best results were obtained in animals given doses of 2 to 3 mg/kg/day of Azathioprine combined with 100 mC $^{90}$Y implants. The response of dogs to extra-corporeal $\gamma$ irradiation of circulating blood was studied using a $^{90}$Sr applicator. Ten dogs exposed for periods of 4 to 14 days showed a lymphocytopenia of from 5 to 35% of pre-irradiation values. Animals given 50 mg keyhole limpet hemocyanin (antigen) one day after the induction of the radiation shunt showed much less formation of precipitating antibody than did control animals. The effects of extracorporeal $\gamma$ radiation of circulating blood in combination with prior thymectomy on the survival of renal homotransplants were also studied in a small group of dogs and a significant prolongation was demonstrated. Extra-corporeal $\gamma$ irradiation of circulating blood, using the $^{90}$Sr applicator, was used in the treatment of acute rejection following renal transplantation in two human patients with good results in one patient and poor results in the other. Extracorporeal blood $\gamma$ irradiation, using a small portable $^{90}$Sr applicator that allowed patient mobility, induced a reduction of total white cell count in two patients with chronic lymphocytic leukemia. The effects of local x radiation to one of two tissue transplants in the neck and pelvis on the survival of dogs and the effects of actinomycin combined with local graft x irradiation on the survival of renal homografts in dogs were also studied. (C.H.)

**43014** (RLO-581-10, pp 33-6) CLINICAL STUDIES [ON LEUKEMIA]. (Oregon Univ., Portland. Div. of Experimental Medicine).

Data are summarized on approximately 600 leukemia patients treated with $^{32}$P or drugs. The efficacy of $^{32}$P was compared to Leukeran and triethylene melamine for the treatment of chronic lymphatic leukemia and to myelaran for the treatment of chronic granulocytic leukemia. Although the $^{32}$P-treated group appears to have fared better in all respects, the total numbers are to small and the fraction living too large to yield statistically significant differences. A total of 11 out of 102 patients with polycythemia rubra vera treated with $^{32}$P developed acute monocytic leukemia. Initial studies on the effects of triethylene melamine in the treatment of polycythemia are reported in progress. Preliminary results are reported from a comparison of the relative efficacy of external localized high-dose x irradiation and nitrogen mustard for the control of lymphomas. Hemoglobins from 3 members of one family with polycythemia and serum proteins from 13 new patients with plasmocytic myeloma were analyzed and ultracentrifugal and other techniques are discussed. (C.H.)

**43015** (UCRL-16246, pp 1-18) CLASSIFICATION AND EVOLUTION OF PATTERNS OF ERYTHROPOIESIS IN POLYCYTHEMIA VERA AS STUDIED BY IRON KINETICS. Pollycove, Myron; Winchell, H. Saul; Lawrence, John H. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

Work directed toward classification of the diverse patterns and definition of the evolutionary history of erythropoiesis in this disease is reported. Possible bases for the pattern of evolution of erythropoiesis documented in this work are discussed. Sixty-four patients with polycythemia vera were studied by means of iron kinetics using $^{59}$Fe labeled ferrous citrate. Seven of these patients had repeat iron-kinetic studies over a 12-year period. The clinical course and pathologic findings at postmortem examination on the patients were correlated with iron-kinetics findings. The results suggest the potential usefulness of iron or splenectomy in polycythemic patients with myeloid metaplasia and anemia dependent upon the presence of the frequent finding of iron deficiency or the occasional finding of splenic sequestration of red cells in excess of splenic erythropoiesis. (H.G.D.)

**43016** (UCRL-16246, pp 58-65) A PRELIMINARY CURVE RELATING DOSE IN TIME TO PITUITARY HISTOLOGIC CHANGE FOLLOWING 910-Mev ALPHA-PARTICLE IRRADIATION. Hazel, Joseph J.; McDonald, Larry W.; Gottschalk, Alexander (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

A retrospective attempt to establish a dose-effect curve relating dose and time to an arbitrarily chosen level (50% or more) of destructive cellular change in the pituitary gland following its irradiation with 910-Mev alpha particles from the 184-in. synchrocyclotron is presented. Fifty-six cases were studied, representing advanced carcinoma of the breast with widespread metastases and including seven patients with diabetes showing diabetic retinopathy. These cases were treated with pituitary irradiation in an attempt to produce a hypophysectomy in the hope of influencing the course of their disease. The patients all had normal pituitary glands except for three who showed metastases in the gland from the carcinoma of the breast at autopsy. Maximum tumor dosages at the center of the pituitary gland ranged from 10,800 rads in 14 days to 36,500 rads in 12 days. The cases were assessed at autopsy at 2½ months or more following the irradiation to the pituitary gland, and a level of 50% or more of cellular damage in the pituitary was used as a criterion of significant ablation in an effort to construct a time-dose-effect curve. The curve relating dose and time with 50% destructive change was linear and extrapolated to approximately 8500 rads in a single treatment to co-relate with 50% or more pituitary damage histologically. Approximately 70% or greater change in the pituitary resulted in a clinical response in the majority of patients. (H.G.D.)

**43017** (UCRL-16246, pp 66-73) TECHNIQUE OF PATIENT ALIGNMENT FOR PITUITARY IRRADIATION WITH HIGH-ENERGY 910-Mev ALPHA PARTICLES. Gottschalk, Alexander (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

The technique of patient alignment prior to pituitary irradiation with high-energy alpha particles is described, and a consideration of dose-limiting factors and anatomic variability discussed. (auth)

**43018** HIGH-ENERGY ELECTRON THERAPY AND THE TWO-COMPONENT THEORY OF RADIATION. Wideroee, R. (Swiss Federal Inst. of Tech., Zurich). Acta Radiol. Therapy, Phys., Biol., 4: 257-78(Aug. 1966).

Clinical experience with bronchial carcinoma shows that survival curves obtained with cell cultures exposed to 35 Mev are not directly applicable to therapeutic irradiations. The inconsistency that may be due to different recovery effects for conditions in vitro and in vivo. For a mathematical investigation radiation is divided into a densely ionizing $\alpha$-component producing exponential dose-effect curves and a sparsely ionizing $\beta$-component producing shoulder-curves. It is postulated that the 37% dose for the $\beta$-component (linear part of the curve) is increased by a recovery factor k for cells in vivo as compared to cell cultures. An example is given, showing that curve parameters may be chosen so as to agree with results in vitro as with radiotherapeutic experience. Therapy with high-energy electrons having only a small part of the $\alpha$-component ($\alpha$ about 5%) gives the best recovery and superior treatment results, especially when high single doses, resulting in increased electivity, are used. (39 references). (C.H.)

**43019** ACUTE GASTRIC ULCERS INDUCED BY RADIATION. Sell, A.; Jensen, T. Skov (Radium Center for Jutland, Arhus, Denmark). Acta Radiol. Therapy, Phys., Biol., 4: 289-97(Aug. 1966).

Previously reported gastric lesions produced by radiotherapy are briefly reviewed and four cases of gastric ulceration following the $^{60}$Co teletherapy irradiation of lumbar lymph nodes associated with malignant testicular tumors are discussed. The tolerance limit of the normal gastric mucosa was found to be about 4,000 R during 5 to 9 weeks, in keeping with the experience of other authors. (auth)

**43020** ROENTGEN IRRADIATION AT 200 kv OF NEOPLASMS OF THE NASOPHARYNX. TECHNIQUE AND DOSE DISTRIBUTION. Nordberg, Ulla-Brita; Olivecrona, Hans (Univ. of Lund, Sweden). Acta Radiol. Therapy, Phys., Biol., 4: 305-10(Aug. 1966).

A technique employing an arc x ray therapy apparatus for the treatment of malignant neoplasms of the nasopharynx is described. Close agreement was obtained between the calculated and the true dose distributions as measured both in a phantom and clinically. (auth)

**43021** THE ORGANIZATION OF CLINICAL DOSIMETRY. II. SOME SPECIAL TOPICS IN TREATMENT PLANNING. Cohen, Montague (International Atomic Energy Agency, Vienna). Acta Radiol. Therapy, Phys., Biol., 4: 311-35(Aug. 1966).

The organization of clinical dosimetry in four stages, which was described for teletherapy in Part I of this review, is discussed with reference to brachytherapy. Some recent developments are mentioned, including afterloading, computer evaluation of doses due to arrays of sealed sources, and the replacement of radium by other radioisotopes. Some special topics mentioned earlier in this review are described in more detail: axial transverse tomography, pre-calculated treatment plans, atlases of isodose charts, and the rapid assessment of treatment plans. A policy for treatment planning is suggested for developing radiotherapy centers. (163 references). (auth)

**43022** USE OF SHORT-LIVED NUCLIDES IN MEDICAL RESEARCH. Soeremark, Rune (Harvard Univ., Boston). Contract AT(30-1)-3481. Advances Biol. Med. Phys., 10: 91-148(1965). (NYO-3481-3).

In the past few years there has been renewed interest in short-lived nuclides for medical research, diagnosis, and therapy. Short-lived nuclides are very often more useful than long-lived ones for diagnosis and therapy. In medical research a half-life is considered short if it can be reckoned in hours. Procedures for production of short-lived nuclides are given. Neutron irradiation is performed in nuclear reactors and neutron generators by means of alpha neutron or gamma neutron sources. Separation and purification are referred to as processing. Small lead shieldings are sufficient for most preparations since only microcurie amounts are prepared at one time for most biological work. In the last few years great improvements have been made in radiation detectors, with respect to both reliability and counting speed of the instruments. The proportional counters now available for counting beta particles are far superior to Geiger-Mueller tubes. Measurements of gamma energies were highly improved with the development of the scintillation detector, which has become the most useful detector in the medical field. Other devices being used are semiconductor detectors and pulse height analyzers. Measurement of many gamma-emitting nuclides is done with the summing coincidence spectrometer and the total-absorption spectrometer. These spectrometers minimize background and interferences. Autoradiographic techniques have been developed for use with short-lived nuclides. Short-lived nuclides are recommended for clinical investigations because of lower radiation dose received by the patient. Areas in which short-lived nuclides are of distinct advantage are activation analysis, double-tracer techniques, and autoradiography. Whole-body counters are very valuable for in vivo studies with short-lived nuclides. They are designed for detecting very low concentrations of internally deposited gamma-emitting nuclides. Many short-lived nuclides are of interest in experimental work with photoscanning systems. (H.L.W.)

**43023** JUVENILE LARYNGEAL PAPILLOMATOSIS: THE RELATION OF IRRADIATION TO MALIGNANT DEGENERATION IN THIS DISEASE. **Rabbett, William F. Ann. Otol. Rhinol. Laryngol., 74: 1149-63(Dec. 1965).**

The records of eight patients are reported who were treated in childhood with varying amounts of irradiation for papillomatosis of the larynx (a benign disease) and later developed invasive carcinoma at the site of radiation. The detailed history of a ninth patient whose case was carefully followed for 23 years is described. Many reports have shown that radiation therapy caused no recession of such lesions and no prevention of their recurrence after surgical removal, and most observers have expressed a strong disapproval of radiation therapy in laryngeal papillomatosis. Reasons why irradiation should not be used in juvenile laryngeal papillomatosis are given. Stenosis may result from excessive destruction of the laryngeal tissues by irradiation and interference with the growth of the laryngeal cartilages as age advances. In the ninth case reported here the patient had an infantile and stenotic larynx when surgically removed at the age of 23 years. He had received radiation therapy to the larynx in early childhood in an attempt to control the rapid growth of the papillomatous tissue. Besides the destructive effect of irradiation on the laryngeal tissues, there is convincing evidence that irradiation may cause malignant transformation of benign laryngeal papillomatosis at the site of treatment. The medical literature failed to reveal any report of a patient who had juvenile laryngeal papillomatosis in childhood progressing to malignancy unless he had undergone radiation therapy; however, there are many cases of malignancy occurring in the larynx of adults with papillomatosis that had not been irradiated. (TCO)

**43024** RENAL PHLEBOGRAPHY BY SELECTIVE ANGIOGRAPHY USING AN ULTRA FLUID LIPIODOL EMULSION. Cherigie, E.; Guerbet, M.; Doyon, D.; Chenard, J.-Cl.; Bouskela, R. (Univ., Saint-Antoine, Paris). Ann. Radiol., 9: R449-60(1966). (In French).

A new iodinated emulsion has been used experimentally. This is injected intraarterially and produces excellent pictures of the intra- and extra-renal venous system. These experiments have been carried out in dogs. The local and general tolerance is satisfactory. Toxicity seems minimal but a longer period of time is necessary for assessment. From the radiological point of view, after the arterial phase, excellent cortical renograms are obtained without the presence of opaque medium in the excretory pathways. The intrarenal veins and renal vein fill densely, homogeneously and constantly. (auth)

**43025** THE EFFECT OF THERAPEUTIC RADIATION ON SERUM AND URINE $\beta$-GLUCURONIDASE. Watts, C.; MacVicar, J.; Goldberg, D. M. (Western Infirmary, Glasgow). Brit. J. Cancer, 20: 282-90(June 1966).

Insertion of radium and subsequent deep x ray therapy in patients with carcinoma of the cervix uteri caused a significant increase in excretion of $\beta$-glucuronidase in the urine. This was most pronounced in patients who had an abnormally high excretion of the enzyme before radiotherapy. Increased serum $\beta$-glucuronidase activity was seen during radium treatment in all but one of the patients. The $\beta$-glucuronidase excretion appeared to be correlated with the activity of the enzyme in the irradiated tumor. It is suggested that the tumor is the direct source of increased urinary enzyme in these patients, and that during radiotherapy the enzyme is liberated from the tissue and is cleared via the kidneys. (auth)

**43026** PROCEDURE FOR CALCULATION OF GONADAL X-RAY DOSE IN DIAGNOSTIC RADIOGRAPHY. Heller, M. B.; Terdiman, J. F.; Pasternack, B. S. (New York Univ. New York City Dept. of Health). Contracts SAph 73722 and PH86-65-24. Brit. J. Radiol., 39: 687-92(Sept. 1966).

The procedure used in calculating gonadal x-ray exposure resulting from diagnostic radiographic examinations conducted in private physicians' offices in New York City is presented. The data collected in this study include technical and patient information relating to 47,000 radiographic exposures gathered in a sample consisting of 679 offices, each supplying data on all examinations and patients for a one month period. Since direct measurement was precluded by the nature of the sample, a unique approach was devised to calculate the gonadal dose for each exposure for the purpose of ultimately arriving at the genetically significant dose to the population. The method is predicated on a one point calibration of each radiographic unit which includes output and HVT determination; a procedure which can predict output and HVT at any kvp for that unit to within 4 per cent; an accurately determined set of measured gonadal doses in a realistic human phantom; and aprocedure for realistically modifying these doses for the anthropometric characteristics of any patient and the technical variables associated with specific examinations. (auth)

**43027** X-RADIATION AND ALKYLATING AGENTS AS POSSIBLE "TRIGGER" MECHANISMS IN THE AUTOIMMUNE COMPLICATIONS OF MALIGNANT LYMPHOPROLIFERATIVE DISEASE. Lewis, F. B.; Schwartz, R. S.; Dameshek, W. (New England Medical Center, Boston). Clin. Exp. Immunol., 1: 3-11(Jan. 1966).

About two of every ten patients with malignant lymphoproliferative disease (chronic lymphocytic leukemia and lymphosarcoma) develop one or more autoimmune complications, including autoimmune hemolytic anemia, idiopathic thrombocytopenic purpura, rheumatoid arthritis, or vasculitis. The pathogenesis of these immunologic abnormalities is obscure, but sudden development of autoimmune hemolytic anemia has been noted after the treatment of some cases with x rays or alkylating agents, and it seemed possible that such therapy might be important in the development of autoimmune complications. This view is supported by the experimental evidence that under certain circumstances x radiation can lead to enhancement of antibody synthesis, abrogate acquired immunological tolerance, and reactivate the graft-vs-host reaction (runt disease). To determine whether any relation can be shown between the use of radiotherapy or radiomimetic drugs and the development of autoimmune complications in malignant lymphoproliferative diseases, 100 cases were reviewed. Seven of these patients were found to develop an autoimmune complication following the use of radiation or radiomimetic drug. The literature suggesting that radiation can enhance as well as suppress the autoimmune response is summarized, and the possibility that radiotherapy can trigger autoimmunity in these patients is emphasized. (BBB)

**43028** NEW METHOD OF BIOLOGICAL AND MEDICAL EXPLORATION: IONOGRAPHY CALIBRATED IN ROENTGENS. **Marchal, Maurice; Weill, Jacky; Marchal, Marie-Therese; Quenee, Robert; Mansui, Guy; Lepinat, Andre. Compt. Rend., Ser. D, 263: 296-9(July 18, 1966). (In French).**

The recording of pulsations of thoracic organs not visible with x rays has been resolved with photoelectric Cinedensigraphy. The new method of Ionography with x rays gives curves calibrated directly in roentgens. It permits precise measuring of pulsation intensity without surgery or the use of isotopes. (H.L.W.)

**43029** EFFECT OF WHOLE BODY IRRADIATION BY X RAYS ON THE THYROID METABOLISM OF THE WHITE RAT. Laborde, Marguerite; Commanay, Louis; Meyniel, Gaston; Blanquet, Paul (Faculte de Medecine et de Pharmacie, Toulouse). Compt. Rend. Soc. Biol., 160: 321-4 (1966). **(In French).**

The thyroid metabolism was studied by the separation of the iodine fractions of the gland on ion exchange resins. As a result of the whole body x irradiation at 200 kv, the thyroid activity in the rat is disturbed in proportion to the exposure dose. Up to a threshold of 300 R there is no significant difference between the irradiated animals and the control. Between 300 and 600 R an exacerbation of the hormone metabolism appears. Above this dose a progressive sideration of the thyroid function occurs. (tr-auth)

**43030** COMPARISON BETWEEN RADIOLOGIC PICTURES AND VOLUMETRIC VENTILATORY DATA IN PULMONARY SCLEROSES SECONDARY TO HIGH ENERGY RADIOTHERAPY OF BRONCHOGENIC NEOPLASM. **Rimondi, C.; Mazzanti, G.; Melica, A. (Univ., Bologna). Giron. Clin. Med., 45: 766-81(Aug. 1964). (In Italian).**

Attempts were made to correlate radiologic and functional evidence of injury to the lungs in the course of telecobalt thoracic irradiation for bronchogenic cancer. Twenty-four patients who received 5000- to 6000-R doses of $^{60}$Co therapy and later developed radiographic evidence of pulmonary sclerosis were studied by a battery of lung function tests. Radiography showed sclerosis in the form of striations or nodules, or a mixed form, but the functional tests showed only minor abnormalities of either the obstructive or constrictive type. There were six cases of pulmonary insufficiency of the obstructive type and one case of the constrictive type. In the remainder of cases lung capacity was normal or only mildly affected as a result of irradiation. Thirteen patients had a respiratory volume within normal limits, eight a slight volumetric deficit, and three a severe deficit. Functional changes, when present, seemed to be related to pulmonary fibrosis of a diffuse type rather than correlating with striations and nodules seen radiographically. Functional improvement, with resolution of atelectasis and fibrosis, often occurred months after radiotherapy had been terminated. (BBB)

**43031** CALIBRATION AND STANDARDIZATION OF THYROID RADIOIODINE UPTAKE MEASUREMENTS. **Gomez Crespo, G.; Vetter, H. (IAEA, Vienna). Int. J. Appl. Radiat. Isotop., 17: 531-49(Sept. 1966).**

199 medical isotope laboratories in 41 countries were visited by an IAEA staff member to calibrate equipment and methods of measuring the uptake of radioiodine by the thyroid gland; full calibrations were done in 190 laboratories. The calibration equipment was constructed in the IAEA laboratory and consisted of a mannequin with exchangeable "thyroids" filled with different amounts of mock-iodine ($^{133}$Ba – $^{137}$Cs), of standards of different sizes and shapes, and of various other items. This equipment and the results of various experiments to test its suitability for the purpose are described. Equipment and methods used by laboratories participating in the project varied greatly. About a third of the 1131 individual measurements of "thyroid" uptake were done with an error not exceeding ±5 per cent and more than half with an error not exceeding ±10 per cent but in individual cases under- or over-estimates by a factor higher than two were returned. Usually, the largest error was found associated with the measurement of the low-uptake "thyroid". An analysis of these results shows the influence of various factors such as collimation, working distance, scattered radiation, volume of standard and extra-thyroidal radioactivity on the final uptake value. A standardized technique of measuring thyroid radioiodine uptake proposed by an IAEA expert group is shown on a fairly realistic mannequin to give results with an error of less than ±5 per cent. In order to minimize differences between uptake values of patients with normal thyroid function which have been reported from various countries and are partly due to differences in equipment and methods employed, this standardized technique is recommended for general use. (auth)

**43032** PRESENT STATUS OF KIDNEY TRANSPLANTATION IN HUMANS. **Pichlmaier, Heinz (Chirurgische Universitaetsklinik, Munich). Internist, 6: 180-4(Apr. 1965). (In German).**

Even with very careful selection of donors there are usually very pronounced immune reactions that are associated with kidney transplantation. Whole-body x irradiation diminishes the immune reaction in humans as well as in rodents. The length of its effects is limited, however, and the side effects produced are rather pronounced. The effect of whole-body irradiation depends on the destruction of cells with immunoactivity. Repeated low doses of whole-body irradiation after transplantation and localized irradiation of the grafted organ in its transplantation bed seems to be the best procedure. This may be related to the fact that the cells that produce immune reactions are most susceptible to injury after they have been activated. Frequently, the irradiation treatments are administered in combination with immunosuppressive drugs. One very recently accepted treatment schema of this type consists of 2 to 4 mg/kg/day of azathioprine, 10 to 60 mg/day of cortisone (prednisone), and localized x irradiation consisting of 2 or 3 irradiations of 100 to 200 R each, given a few days apart from one another. If the patient's reactions are extremely severe, additional cortisone, actinomycin C, or additional irradiations of 100 to 200 R should be given. If 6-mercaptopurine is given instead of azathioprine, a dose of 50 to 225 mg/day should be given. (BBB)

**43033** GROWTH RATE AND RADIOSENSITIVITY OF TUMORS IN MAN. Breur, K. J. Belge Radiol., 48: 763-71(1965).

Accurate measurements of pulmonary metastases in patients with different types of primary tumors were made. These metastases appear on the roentgenogram as a number of circular shadows. Since these shadows occur in a definite area, it was assumed that a tumor embolus gives rise to several metastases after reaching an end-artery in the lung. Measurements were made by superimposing circles with increasing diameters, engraved on transparent plastic rulers, on spherical components of the pulmonary metastases. Measurements were made in 86 cases; in 70 patients data were consistent with exponential growth implying a constant growth rate. If the logarithm of the diameter is plotted as a function of time on a linear scale, a straight growth curve is obtained. The growth rate in terms of doubling time, defined as the number of days in which the metastases doubles its volume, can be derived from this curve. An attempt was made to demonstrate correlation of doubling time with mitotic frequencies; in general lower frequencies were found for slow-growing as compared with fast-growing tumors. Wide variations between growth rates of metastases were found in patients with different types of tumors. Duration of the clinical course was correlated with growth rate of pulmonary metastases. Survival time after diagnosis of pulmonary metastases decreases with increasing growth rates. (H.L.W.)

**43034** FURTHER OBSERVATIONS ON THE TREATMENT OF MALIGNANT TUMORS OF THE TESTIS: DYSEMBRYOMA. Gandolfo, E. (Univ., Genoa). Minerva Radiol., Fisioterap. Radiobiol., 11: 318-24(June 1966). (In Italian)

After a brief description of recent views on the classification and pathogenesis of malignant tumors of the testis, the results obtained in 42 cases of malignant dysembryoma of the testis treated at the Curie Foundation in Paris are described. The various therapeutic techniques, both surgical and radiotherapeutic, are considered, with stress on the advantages and limitations of each. It is concluded that an exact histologic diagnosis is of the greatest importance with respect to the treatment as the results obtained in cases of malignant dysembryoma differ considerably from those obtained in cases of seminoma. (tr-auth)

**43035** RESPONSE TO X-IRRADIATION OF A TUMOR THAT RECURRED FOLLOWING A TCD$_{95}$ RADIATION DOSE. Suit, Herman D. (Univ. of Texas, Houston). Nature, 211: 996-7(Aug. 27, 1966). (CONF-660212-2).

From Radiation Research Society, 14th Annual Meeting, Coronado, Calif.

Isotransplants of C3H mouse mammary carcinomas were placed in subcutaneous tissues of C3H mice. The tumors were irradiated at 5 dose levels. The dose (TCD50) that yielded local control of the tumor in half the treated lesions was 5990 R at 240 days after treatment. A recurrent tumor was noted in one of eight animals at 240 days following 6600 R, or a dose corresponding to TCD95. The small recurrent tumor was excised and isotransplants were made. The TCD50 at 240 days was significantly less for the recurrent lesion, that is, 5080 R instead of 5990 R. In vitro studies showed a gradual reversion toward the normal or control value with prolonged culture. (H.L.W.)

**43036** POSSIBILITIES AND LIMITS OF RADIOLOGICAL AND SCINTILLATION INVESTIGATIONS OF HEPATITIC COMPRESSIONS. Bonanni, G.; Trinci, M. (Univ., Rome). Nunt. Radiol., 31: 1235-49(Nov. 1965). (In Italian).

Differential uptake of the tracer in liver scintigraphy was studied pathogenetically. The effects of extrinsic organ compression on diagnostic fidelity of liver scintigrams were pointed out by comparing scintigrams with autoradiograms of the same region. It was concluded that data obtained by scintigraphy should be supplemented with that from other radiological procedures. (tr-H.G.D.)

**43037** NEOPLASIA OF THE CENTRAL LOBE. POSSIBILITY OF CLINICAL, RADIOLOGICAL, AND ENDOSCOPIC DIAGNOSIS. Pisapia, M. (Univ., Rome). Nunt. Radiol., 31: 1251-72(Nov. 1965). (In Italian).

Various methods for localizing pulmonary neoplasms were compared. Six cases were used to illustrate the correlation of data obtained by radiography, bronchography, bronchoscopy, and histological or cytological examinations. It is concluded that neoplasia of the middle lobe is more frequent than previously believed. (tr-H.G.D.)

**43038** MALIGNANT TUMORS OF THE TESTICLES. (CLINICO-RADIOLOGICAL INVESTIGATION OF 80 CASES). Bellizzi, C. (Istituto del Radio O. Alberti Spedali Civili, Brescia); Gallina, F. Nunt. Radiol., 31: 1273-96(Nov. 1965). (In Italian).

Histopathological, clinical, and therapeutic aspects of testicular tumors are reviewed. A statistical analysis performed on eighty patients with testicular tumors demonstrated the efficacy of widespread use of high energy radiations in treating these tumors. Irradiation techniques for radiotherapy following orchiectomy are discussed. The use of high energy radiation is also indicated in cases of metastatic involvement of lymph nodes, lungs, and bones, particularly when the lesion is extensive. (TCO)

**43039** CLINICAL AND RADIOTHERAPEUTICAL INVESTIGATION OF METASTASES AND CUTANEOUS REAPPEARANCES OF NEOPLASIA IN THE FEMALE INTERNAL ORGANS. Clementi, T.; Trinci, M. (Univ., Rome). Nunt. Radiol., 31: 1297-1320(Nov. 1965). (In Italian).

Twenty-two cases of recidivation and cutaneous metastases of mammary neoplasms (primarily carcinomas and adenocarcinomas), and 11 cases of cutaneous metastases of internal organs (e.g., bones, nasopyarynx, larynx) are reported. Therapeutic measures are discussed with emphasis on radiotherapy. Types of radiation used for treating cutaneous metastases included: x rays, gamma teletherapy, electron beams from a betatron and $^{90}$Y. (tr-H.G.D.)

**43040** DEPTH DOSE CURVES OF HIGH ENERGY ELECTRON BEAMS AS A FUNCTION OF COLLIMATOR CROSS SECTION. Babini, L. (Univ., Bologna); Botti, G.; Skoff, G.; Tosi, G. Radiobiol. Radioterap. Fis. Med., 21: 151-61(May-June 1966). (In Italian).

The influence of the limiters cross section on the depth dose curves of Betatron's electron beams, in the energy range between 14 and 32 Mev was studied. The results showed a displacement towards the surface of the absorption maximum for small fields, with respect to fields of bigger cross section; the amount of this displacement depends on the energy. The depth absorption curves for square and rectangular fields are also compared. Photodensitometric measurements were performed, which were checked against the measures of an extrapolation chamber. (auth)

**43041** RESULTS OF RADIOTHERAPY OF MALIGNANT LUNG TUMORS. INVESTIGATION OF 401 CASES CONSIDERING ESPECIALLY THE DIFFERENCES BETWEEN CONVENTIONAL ROENTGEN THERAPY AND HIGH ENERGY RADIOTHERAPY. Trenta, A.; Bernardi, L.; Bono, F. (Univ., Bologna). Radiobiol. Radioterap. Fis. Med., 21: 201-9(May-June 1966). (In Italian).

After some general premises on primary cancer of the lung, the authors report on the various kind of therapy employed, that is: surgical, radiological, and drug therapy. For each they list indications, limits, and results. Clinical results are summarized on 401 patients, 88 of which were treated with stationary field roentgentherapy, 121 with moving fields roentgentherapy, and 192 with high energy radiations. From the analysis of data, it can be seen that only 15 patients, all of them treated with high energies, are still living 3 years after the treatment. The authors stress the clinical seriousness of this neoplasm, whose prognosis does not seem to be significantly influenced by the therapeutic means at present available. (auth)

**43042** CONVENTIONAL AND HIGH ENERGY RADIOTHERAPY IN TREATMENT OF MALIGNANT TUMORS OF THE RHINO-PHARYNX. Bono, F.; Corinaldesi, A.; Panebianco, G. (Univ., Bologna). Radiobiol. Radioterap. Fis. Med., 21: 210-16(May-June 1966). (In Italian).

Clinical data are summarized on 220 cases of malignant tumors of the rhino-pharynx, of which 164 were treated by 180 kv and endocavitary radium therapy and 48 by high energy radiations. In the patients treated with 180 kv a higher frequency of didfusion to the cranial base (25.9%), recurrences (27.2%), and a shorter survival time (20.9% at 3 years; 16.8% at 5 years) were found in respect to the treatment with high energy radiations. In the latter group cranial base invasion and recurrences were seen in 19% of the cases with survivals of 40.5% at 3 years and 23.8% at 5 years. It was concluded that the course and prognosis of malignant neoplasms of the rhino-pharynx are more favorable in patients submitted to high energy radiations, particularly in the first years following treatment. (auth)

**43043** PROBLEMS IN EVALUATING THE ABSORBED DOSE IN THE GASTROINTESTINAL TRACT AND THE LIVER FROM TREATMENT WITH RADIOISOTOPES INTERNALLY. **Melfi, F.; Li Voti, P. Jr.** (Univ., Palermo, Italy). **Radiol. Prat., 14: 343-50(July-Aug. 1964).** (In Italian).

Various means of calculating the absorbed tissue doses for stomach, small intestine, large intestine, and liver in the internal use of $^{90}$Sr-$^{90}$Y and $^{131}$I in various forms are discussed. Mathematical formulas for estimating the absorbed doses under various conditions are derived and explained. Transit times for various isotopes in the gastrointestinal tract are examined. For example, after ingestion of $^{90}$YCl$_3$, which is only slightly absorbed by intestine, the max dose is delivered to the intestinal mucosa within two to three days and all is excreted by the fifth day. In general, the distal colon receives a higher radiation dose than the cecum or other proximal segments of the gastrointestinal tract. For an insoluble isotope which is not absorbed, the intestinal mucosa dose will be directly proportional to the transient time of the segment in question. Thus, the presence of diarrhea can greatly reduce in intestinal dose from an ingested radioisotope. Under normal conditions introduction of 25 mC of $^{90}$YCl$_3$ will result in a 15,000-rad dose to intestinal mucosa. Some data on enteric absorbed doses during use of $^{131}$I-labeled rose bengal and serum albumin are also considered. (BBB)

**43044** COMPARATIVE EVALUATION OF OOPHORECTOMY AND RADIATION CASTRATION ACCORDING TO THE EXCRETION OF URINARY GONADOTROPINS (H.M.G.). **Juret, P.; Henry, R.; Lalanne, C. M.; Hourtoulle, F. G.; Fermanian, J.** (Institut Gustave-Roussy, Villejuif, France. Faculte de Medecine, Paris). **Rev. Franc. Etud. Clin. Biol., 11: 176-82(Feb. 1966).** (In French).

Fifteen females were castrated by oophorectomy and 19 by irradiation. Gonadotropin excretion was measured 2 months and 6 months after ovarian surgery or after the end of the irradiation. The ovarian irradiation consisted in the administration of 1,500 R telecobalt $\gamma$ rays to the midplane of the pelvis over a 3 to 4 weeks period. After extraction, the gonadotropins were tested on female mice. Uterine weights of animals receiving extracts from surgically castrated women were compared to the uterine weights of animals injected with extracts from radiation castrated women. Four fractions of the daily urinary extracts were tested: $\frac{1}{200}$, $\frac{1}{100}$, $\frac{1}{50}$, and $\frac{1}{25}$, 2 and 6 months after both types of castration. In most cases the mean weight increase of the uterus was larger after pelvic irradiation than after ovarian excision. With 2 dilutions, after 6 months, the differences were statistically significant ($S < 0.05$). It is concluded that the irradiation of the ovaries was physiologically more effective than the oophorectomy. (H.G.D.)

**43045** TREATMENT OF ACUTE LEUKEMIA—ACTUAI AND POSSIBLE RESULTS. **Mathe, G.; Amiel, J. L.; Schwarzenberg, L.; Cattan, A.; Schneider, M.; Schlumberger, J. R.** (Institut Gustave Roussy, Villejuif, France). **Schweiz. Med. Wochschr., 94: 1639-47(Nov. 21, 1964).** (In French).

Total irradiation with a dose of $^{32}$P sufficient to provide a dose of 300 R produces remissions only rarely and there is usually recurrence. Irradiation with a lethal dose of 800 to 1000 R can be followed with transfusion of marrow cells. In mice the irradiation dose necessary to destroy the tumor is more than 3000 R. In addition, the existence of very radioresistant cells means that even though a tumor may disappear after local irradiation with a moderate dose these cells may remain. Isogenic transfusion of marrow cells obtained from a patient in remission may be used as a transfusion after the patient has been irradiated with as much as 800 R. However, in autologous transfusions a certain number of tumor cells that have survived may be reinjected even though remission may appear to be complete. In this case it would be doubtful if the leukemia could be completely cured. Irradiation may be only one of several approaches or combinations of treatments that can be used for complete eradication of leukemic cells. Along with irradiation of 800 R allogenic marrow cell transfusions may offer some possibilities for effective therapy of acute leukemia. (127 references). (BBB)

**43046** RADIATION BURDEN IN THE THERAPEUTIC USE OF THORIUM X ($^{224}$Ra). **Schales, Fritz** (Max-Planck-Institut fuer Biophysik, Frankfurt am Main). **Strahlentherapie, 130: 420-5(July 1966).** (In German).

Thorium X ($^{224}$Ra, half life 3.64 days) has been used therapeutically in Germany for a long time. In dermatology it is used in the form of creams and ointments and is injected intravenously for the treatment of ankylosing spondylitis (Marie-Strumpell). Intermittent use of high ThX-doses in the drug "Peteosthor" in the treatment of tuberculosis of bones and joints, especially in children, has caused late damages which are discussed. Experimental results were used for calculating the radiation dose received by various organs of patients with ankylosing spondylitis, who had been treated intravenously with ThX. This dose is compared with the radiation dose received with X-ray therapy. The extent of contamination of ThX with its long lived parent was determined. The radiation doses calculated are compared with doses resulting from $\mu$Ci amounts of $^{226}$Ra or of 20 ml of Thorotrast, respectively. The approximate value of radiation exposure of personnel and other patients during the treatment is determined. (tr-auth)

**43047** EXPERIMENTAL STUDIES ON DOSE DISTRIBUTION BY USE OF DIFFERENT FILTER ELEMENTS IN CONES. **Weishaar, Julius; Graf, Regina; Reuss, Albrecht** (Univ., Erlangen-Nuernberg, Ger.). **Strahlentherapie, 130: 495-503(Aug. 1966).** (In German).

An additional x-irradiation, in form of a modified Marburg method (cone field size 8 × 15 and 8 × 17 cm, use of compensation filters), results in a favorable dose distribution from the center of the pelvis to its walls even in cases of radium doses of about 6000 mgeh. Tables and figures are used to demonstrate the dose distribution within the radiation cone. The effect of a given radium dose on this dose distribution is discussed. (auth)

**43048** QUESTION OF DAILY RHYTHMIC VARIATIONS IN RADIATION SENSITIVITY IN TUMOR-BEARING MICE AND CONTROL ANIMALS. **Fochem, Kurt; Michalica, Werner; Picha, Engelbert** (Univ., Vienna). **Strahlentherapie, 130: 590-4(Aug. 1966).** (In German).

In continuing the investigations concerning the diurnal radiation effect variations in rats, the problem of variations in the radiation sensitivity during the daily rhythm in tumor bearing mice and control animals is discussed. It was observed, that not only rats, but also mice show a variation in the radiation effect during the daily course. The tumor bearing mice, which were inocculated partly peritoneally and partly subcutaneously, showed a higher radiation sensitivity of the tumor, when irradiated in the evening (9 p.m.) as compared to the morning (9 a.m.). (auth)

**43049** BONE DENSITY MEASUREMENT BY MEANS OF RADIOISOTOPIC SOURCE PHOTON ATTENUATION. **Gilson, Albert J.** (Univ. of Miami, Fla.); **Cohen, Martin J.; Day, Frank.** 24p. (CONF-650647-4). ORAU. Gmelin, AED-CONF-65-197-3.

From Society of Nuclear Medicine, 12th Annual Meeting, Bal Harbour, Fla.

An instrument for in vivo bone density (mineralization status) measurements capable of 1% accuracy is described. Two gamma sources ($^{241}$Am and $^{125}$I) are used to provide differing gamma energies. A NaI detector and low-noise PM tube are used to detect the degradated gamma photons. Complications arising in quantitative measurements such as soft tissue absorption of gammas, effects of organic bone matrix, bone dimensions, radiation scatter, effects of nonchromaticity of radiation, and collimation difficulties are considered. (R.E.U.)

**43050** CRITICAL ORGAN EXPOSURE DURING FLUOROSCOPY WITH AN ANALYSIS OF CONTRIBUTING PARAMETERS. **Sprawls, Perry, Jr.; Miller, W. B. Jr.; Weens, H. S.; Cosper, John H.** (Emory Univ., Atlanta).

27p. (CONF-651139-2). ORAU. Gmelin, AED-CONF-65-444-1.

From Radiological Society of North America, 51st Annual Meeting, Chicago.

Patient exposure during fluoroscopic examinations is related to physical parameters such as exposure area, exposure time, output of x-ray machine, and x-ray beam quality. Physical parameters are in turn related to doctor and patient characteristics. Average values for the physical parameters were found to vary with each examining doctor because of differences in examining techniques, training, etc. So in the final analysis the doctors were grouped either as members of the permanent radiology department staff or as residents in training. Patient characteristics analyzed were age, weight, height, and sex. Equations are presented in which patient exposure is directly related to the physical examination parameters. Simple linear regression equation models were used. (H.G.D.)

**43051** RECENT ADVANCES IN NUCLEAR MEDICINE. Based on a Symposium Sponsored by the Department of Radiology of the Hahnemann Medical College. Croll, Millard N.; Brady, Luther W. (eds.). New York, Appleton-Century-Crofts, 1966. 270p. $12.50.

Four areas of nuclear research were discussed at the Symposium on Nuclear Medicine: instrumentation, dynamic function studies, radiopharmaceuticals and dosimetry, and organ scanning. A digital autofluoroscope is described, and comparisons are made of methods for rate recording and of the use of digital and analog readout systems in the interpretation of radioisotope data. Physiological studies of the circulatory system and kidneys using radioisotopes, and the use of a computer to perform a regression analysis between the body parameters of height and weight and the measurement of circulating blood volume are reported. Dosimetry of beta-type absorbed dose from non-beta-emitting radionuclides and of various compounds labeled with $^{197}$Hg, $^{203}$Hg, $^{75}$Se, or $^{99m}$Tc is considered. Apparatus, techniques, and applications for organ scanning are presented and illustrated by studies on liver, brain tumors, lungs, parathyroids, bones, and spleen. (H.G.D.)

**43052** AUTOFLORA KAK INDIKATOR RADIATSIONNOGO PORAZHENIYA ORGANIZMA. (Autoflora as an Indicator of Radiative Injury of an Organism). Klemparskaya, N. N.; Shal'nova, G. A. Moscow, Izdatel'stvo Meditsina, 1966. 208p.

The indigenous bacteria as a cause of endogenous infection during radiation sickness was analyzed. Methods for investigating indigenous bacteria changes in various parts of the body in irradiated animals, local irradiation and changes of indigenous bacteria in humans, and the causes producing an increased amount of indigenous bacteria in irradiated organisms are discussed. Use of antibiotics and chemotherapeutic preparations and other means for bringing the bacteria level back to normal were studied. Extensive bibliographies are included. (R.V.J.)

**43053** PHANTOM FOR DETERMINING RADIATION DOSES. Bibergal, Anotoly Victorovich; Nikulin, Jury Pavlovich; Rather, Tatjana Grigorjevna (to Institute Biologicheskoi Fisiki). British Patent 1,041,354. Sept. 7, 1966. Filed Jan. 24, 1964.

A phantom used in determining gamma or x radiation doses at energies above 400 kev was designed. The phantom consists of a container shaped approximately like a human body, constructed of a flexible, resilient, watertight material. Belts are provided to shape the appropriate human form. An ionization chamber mounted on a rod is inserted at the neck through a universally jointed hermetic seal. (F.S.)

**43054** APPARATUS AND METHOD FOR THE DETERMINATION OF FLUID VOLUME BY RADIOACTIVE DILUTION TECHNIQUES. Stoddart, Hugh F.; Williams, James B.; Hindel, Robert (to Miles Labs., Inc.). U. S. Patent 3,268,728. Aug. 23, 1966. Filed Mar. 3, 1964.

An apparatus and method used to determine the fluid volumes of circulating blood within min. for surgical or clinical use by radioactivity dilution techniques are described. Direct blood volume without volumetric pipettings, computations, or specially trained personnel are read on the apparatus. Limits of accuracy of better than 5% are maintained even after several determinations. More than one isotope may be used. (F.S.)

# CHEMISTRY

## General

**43055** (STI-PUB-21/19) CHEMISTRY OF TRANSPLUTONIUM ELEMENTS. Bibliographical Series No. 19. (International Atomic Energy Agency, Vienna (Austria)). June 1966. 240p. IAEA: $5.00; S 105,-; £1.10.0; F Fr 20,-; DM 17,50.

References (1034) on the chemistry and physics of transplutonium elements are given to journals and reports published from 1951 to 1964 and 1958 to 1964, respectively. The references are presented alphabetically by author. Separate author and subject indexes are included. (P.C.H.)

**43056** (JPRS-36943) NUCLEAR CHEMISTRY. Gol'danskii, V. I.; Lavrukhina, A. K. (eds.). Translated from pp 3-329 of Yadernaya Khimiya, Izdatel'stvo Nauka, Moscow, 1965. 455p. (TT-66-33373). CFSTI $7.50 cy, $2.00 mn.

Information is included on: effects of nuclear reactions in meteorites caused by fast protons; chemical composition and origin of galactic cosmic rays; fragmentation by high-energy particles; formation of tritium and more complex particles in nuclear reactions caused by high-energy protons; radiochemistry of secondary reactions of astatine formation during the bombardment of Bi and Pb with high-energy particles; direct nuclear reactions in the high-energy region; mechanism of nuclear reactions under the influence of heavy ions; origin of isotopes of rare earths in the solar system; chemistry of hot atoms in condensed systems of organic substances; restoration of the pulse distribution of annihilating electron-positron pairs by angular correlation of gamma-quanta; use of Hartree-Fock method in problems of the annihilation in condensed media of the ionic type; use of Moessbauer effect in solution of chemical and geochemical problems; annihilation of positrons from polaron states in alkali-halogen crystals; molecular neutronoscopy; physics and chemistry of muonium; and mechanism and parameters of chemical reactions by depolarization of $\mu^+$-mesons. (P.C.H.)

## Analytical Procedures

### *See also* Separation Processes and Procedures

*Refer also to abstract 43256.*

**43057** (AAEC-TM-321) CONDENSED TABLES FOR X-RAY FLUORESCENCE ANALYSIS. Brockman, R. H.; Whittem, R. N. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). May 1966. 64p. Dep. mn.

Condensed tables of 2 $\theta$ angles, which were extracted from x-ray wavelength data, were calculated by a simple computer program. Each double page of the tables included gives the entire accessible K or L spectrum for a selected crystal. The computer program is appended. (P.C.H.)

**43058** (AERE-Bib-136(Pt.2)) X-RAY FLUORESCENCE ANALYSIS. (PART 2. INDEXES). Stoddart, H. A.; Dowden, W. A. (Atomic Energy Research Establishment, Harwell (England)). May 1966. 14p. Dep. BIS $1.20. HMSO 6s. 0d.

A bibliography on x-ray fluorescence analysis is presented primarily in the form of element determined and matrix analyzed. Additional indexes are provided for equipment, methods, and theory, and for general articles on x-ray fluorescence analysis. A split-page coordinate index was used in the elements determined and matrix sections. References are also given to sample preparation and coating thickness. (P.C.H.)

**43059** (BNWL-SA-674) TRACE ELEMENTS AND $^{137}$Cs IN SEA WATER BY GAMMA-RAY SPECTROMETRIC TECHNIQUES. Robertson, D. E.; Perkins, R. W. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug. 31, 1966. Contract AT(45-1)-1830. 10p. (CONF-661008-3). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 1st Materials Research Symposium on Trace Characterization: Chemical and Physical, Gaithersburg, Md.

The trace elements cesium, uranium, antimony, cobalt, and scandium were simultaneously measured without performing a chemical separation in sea water by using activation analysis and multidimensional gamma spectrometry techniques. Sea water samples (0.500 to 1.000 ml) were irradiated in an integrated neutron flux of about $10^{19}$ neutrons and allowed to decay for about 5 weeks. The samples were then counted for 1000 minutes on a multidimensional gamma spectrometer. The trace elements were measured in surface samples taken at several locations in the Pacific Ocean between the Oregon coast and Hawaii and in a depth profile taken 500 miles off the California coast. The nuclear weapons-produced $^{137}$Cs was also measured in a depth profile by separating the $^{137}$Cs on a small potassium cobalt ferrocyanide column and counting the column material directly. The variations in concentration, their physical forms, and the analytical problems in measurements at the sub-parts-per-billion range are discussed. (auth)

**43060** (CEA-R-2967) QUELQUES APPLICATIONS DE L'ANALYSE PAR RADIOACTIVATION NEUTRONIQUE EN BIOLOGIE VEGETALE ET EN AGRONOMIE. (Some Applications of Neutron Activation Analysis in Plant Biology and Agronomy). Fourcy, Andre (Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires). June 1966. 36p. Dep. mn.

With the help of concrete examples, applications of neutron activation analysis to the determination of some metals (Mn, Cu, Co, Fe, Zn, and K) in plant materials, are proposed. Samples are activated in a swimming pool reactor at the thermal flux of $5 \times 10^{12}$ n cm$^{-2}$ sec$^{-1}$ for a time varying between a few minutes and several days according to the element being analyzed. The induced radioactivity is measured by spectrometry, with radiochemical separation (Cu, Co, Fe, Zn, and K) or without separation in some cases (Mn, Cu, K). Dosages are described for: manganese in grass; copper in vine treatments; cobalt, iron, and zinc in animal feeding; and potassium in a radioecological experiment. (auth)

**43061** (CEA-R-2998) METHODE SIMPLIFIEE DE DOSAGE DU $^{90}$Sr SUR DES QUANTITES IMPORTANTES DE CENDRES D'OS. (Simplified Method for the Determination of $^{90}$Sr in Large Amounts of Bone Ash). Patti, Francois; Jeanmaire, Lucien (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). June 1966. 10p. Dep. mn.

The method consists of concentrating the strontium by attacking the ash with nitric acid, eliminating the residual phosphoric ions by double precipitation of strontium oxalate, and extraction of yttrium-90. Using this method it is possible to treat 50 g of ash. The initial concentration of the strontium considerably reduces the volume of the solutions as well as the size of precipitates. The design of a special burette for use with nitric acid is described. (P.C.H.)

**43062** (CONF-661011-1) ACCOUNTABILITY OF $UF_6$ SUPPLIED TO THE PADUCAH GASEOUS DIFFUSION PLANT BY A PRIVATE FIRM. Burkhalter, L. C.; Fortune, M. B. (Paducah Gaseous Diffusion Plant, Ky.). [nd]. Contract W-7405-eng-26. 6p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From AEC Contractors' Nuclear Materials Management Meeting. Berkeley, Calif.

Experiences encountered in handling uranium materials as $UF_6$ between the Paducah Gaseous Diffusion Plant and the General Chemical Plant are reported. The major problems encountered were those of product sampling and weight control, and experience indicated that good sampling procedures and adequate weighing facilities which are properly used, maintained, and controlled minimize these problems. (P.C.H.)

**43063** (EUR-2990.f) DETERMINATION RADIOCHIMIQUE DES CHLORURES DISSOUS DANS L'EAU (RAPPORT FINAL). (Radiochemical Determination of Chlorides Dissolved in Water. Final Report). Rygaert, J.; Clauss, A.; Beaudet, C. (Societe d'Etudes, de Recherches et d'Applications pour l'Industrie, Brussels (Belgium)). 1966. 16p. Dep. mn.

The chlorine ions are determined by measuring, after the addition of Ag-110-labeled silver nitrate, the activity of the tracer in the supernatant liquor after precipitation of the silver chloride. This process, a simple one, reduces the hazards linked with the handling of radioisotopes and is sensitive enough for chlorine ion determination up to 5 ppM, as the majority of the dissolved substances cause no problem at the concentrations normally encountered. (auth)

**43064** (EUR-2991.f) DETERMINATION RADIOCHIMIQUE DE L'OXYGENE DISSOUS DANS L'EAU (RAPPORT FINAL). (Radiochemical Determination of Oxygen Dissolved in Water. Final Report). Rygaert, J.; Clauss, A.; Beaudet, C. (Societe d'Etudes, de Recherches et d'Applications pour l'Industrie, Brussels (Belgium)). 1966. 36p. Dep. mn.

The oxygen dissolved in natural and industrial water can be quantitatively determined by radiochemical means. Thallium metal is put into stoichiometric solution. Since the thallium is labeled with Tl-204, the activity of the thallous ions in the solution after the reaction is a direct measure of the oxygen concentration, with which the activity varies linearly. The reaction is unaffected by the majority of the substances dissolved at pH values between 5 and 10. A specific activity of 1 mC/g/Tl makes it possible to determine oxygen contents down to 0.1 ppM. (auth)

**43065** (GAT-T-1403) MEASUREMENTS AND RESULTING SHIPPER-RECEIVER DIFFERENCES INVOLVING URANIUM COMPOUNDS ABOVE FIVE PERCENT $^{235}$U. Wernecke, A. H. (Goodyear Atomic Corp., Piketon, Ohio). Oct. 3, 1966. Contract AT(33-2)-1. 25p. (CONF-661011-3). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From AEC Contractors' Nuclear Materials Management Meeting, Berkeley, Calif.

Uranium compounds, returned to the AEC for credit, require sampling and analytical measurements to determine shipper-receiver differences and to assess conformance to published specifications. The determination of sampling groups, the method of obtaining representative samples, and analytical measurements and their limits of error are discussed. Tabulation of shipper-receiver differences is also presented. (auth)

**43066** (IDO-14679) ANNUAL REPORT OF DIVISION ANALYTICAL BRANCH FOR 1965. Shank, Ralph C. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). June 1966. Contract AT(10-1)-205. 233p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

Four sections and two appendices are included; separate abstracts were prepared for each. (P.C.H.)

*For abstracts of individual sections see: 43067-43072.*

**43067** (IDO-14679, pp 6-46) ANALYTICAL DEVELOPMENT. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Developments are reported for analytical developments in: wet chemistry methods; radiochemical methods; electroanalytical studies; LOFT program; remotely operated facilities; and burnup determination of nuclear fuel. (P.C.H.)

**43068** (IDO-14679, pp 47-50) SPECTROSCOPY. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Results are reported for the use of spectrochemical analysis for determination of Ir in Al, B in Th, and separation and determination of $^{151}$Sm in CPP feed solutions. Improved equipment and methods are also reported for: installation of ion pumps on mass spectrometers; installation of microfocus x-ray diffraction unit; detection of hydrocarbons in reactor containment buildings; conversion of CEC vacuum system; restoration of spectrograph for SNAP test; analysis of deliquescent and pyrophoric samples by x-ray diffractometry; silver spark-rotating platform technique for spectrochemical determination of rare earths; and installation of vacuum lock on Tandem mass spectrometer. (P.C.H.)

**43069** (IDO-14679, pp 51-9) CHEMICAL ANALYSIS. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Manpower requirements for different analyses, analytical services, and improvements in methods and equipment are discussed. Specific methods are described for: analysis of polystyrene filters for Se; dissolution of ternary fuels; analysis of irradiated Th samples; determination of Cu and Al in Cu-Al alloys; colorimetric determination of I; determination of Sr in stainless steel; simultaneous determination of $^{133m}$Xe and $^{135}$Xe; I loss in polypropylene dissolvers; determination of inorganic nitrate and ammonia; high activity gamma spectrometry; purification of Hg; improvements in waste disposal system. A new design for Castle Manipulators bellows is also discussed. (P.C.H.)

**43070** (IDO-14679, pp 60-9) STANDARDS AND QUALITY CONTROL. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Discussion is presented on umpire service, implementation of program, status of program, and future plans for the Umpire Qualification Program. Bias and precision data, training and testing program, and standards and reagents are also discussed in relation to quality control. (P.C.H.)

**43071** (IDO-14679, pp 75-191) METHODS ADDED TO ANALYTICAL MANUAL IN 1965. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Methods are described for determination of: acidity of hydrolyzable ion solutions by titrimetry; fluoride by microdistillation-colorimetry; uranium by extraction-fluorophotometry; milligram amounts of uranium by extraction-spectrophotometry; selenium by colorimetry; thorium and aluminum in thorium metal and thorium metal slug clad with aluminum by titrimetry; iodine by colorimetry; inorganic nitrate and ammonia; milligram levels of phosphorus as molybdivanadophosphoric acid by spectrophotometry; chromium(VI) by volumetry; peroxide by titrimetry; iron with 1,10-phenanthroline by colorimetry; and total carbon. (P.C.H.)

**43072** (IDO-14679, pp 193-229) METHODS ADDED TO ANALYTICAL RADIOCHEMICAL MANUAL IN 1965. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Methods are described for: determination of $^{241}$Am in samples containing Th, U, Np, and Pu; determination of $^{143}$Ce in samples containing $^{239}$Np; determination of $^{237}$Np in high concentration $^{235}$U samples; absolute beta counting of low-activity liquid-waste samples; determination of gross beta activity; and dissolution and separation of 10-day fission products. (P.C.H.)

**43073** (JINR-P-2804) ISSLEDOVANIE DIFFUZII PRODUKTOV YADERNYKH REAKTSII V RAZLICHNYKH MATERIALAKH. (Investigation of the Diffusion of the Nuclear Reaction Recoil Products in Different Materials). Tarantin, N. I.; Gordeev, V. V.; Dem'yanov, A. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1966. 14p. Dep. mn.

Results are given for studies on release time of the nuclear reaction recoil products, trapped in a plate heated to 1750°C. It was found that ≈50% of Dy nuclei, trapped in a tantalum plate, were emitted during ≈0.1 sec. The experiments were aimed at use of this method for the introduction of reaction products into the ion source of the electromagnetic separator, required for quick identification of short-lived nuclear reaction recoil products. (auth)

**43074** (LA-DC-7831) IMPROVEMENTS IN THE PRECISE MEASUREMENT OF GAMMA ACTIVITY. Matlack, G. M.; Metz, C. F.; Bubernak, J. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1960]. Contract W-7405-eng-36. 14p. (CONF-661012-3). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From IAEA Symposium on the Standardization of Radionuclides, Vienna, Austria.

Techniques for measuring the gamma activity of liquid and large solid samples are described. They are based on improvements in the precise measurement of the gamma activity of the fissionable material. A 140-cm model fuel element analyzer, which is described, would enable measurements to be made in one second with a precision of 0.2%. A technique is also described for the precise determination of enriched uranium gamma activity which requires no specialized equipment other than the sample containers. (P.C.H.)

**43075** (LA-DC-7931) INTERFERENCE REDUCTION AND SENSITIVITY IMPROVEMENT IN ACTIVATION ANALYSIS. Holm, Dale M.; Sanders, Wm. Mort (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1964]. Contract W-7405-eng-36. 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 1st Materials Research Symposium on Trace Characterization: Chemical and Physical, Gaithersburg, Md.

Three detector geometries were investigated for minimization of interferences in the determination of oxygen in sodium by photon activation. The best of the three was a gated well, with which an oxygen concentration of 30 ppM was measured and with which 3 ppM should be detectable. Significant improvement in sensitivity was obtained by separating the pure positron emitters from the positron emitters having coincident gamma rays. Further improvements are possible, by using a pair of large crystal detectors and a multiparameter pulse height analyzer. (auth)

**43076** (NAS-NS-3058) THE RADIOCHEMISTRY OF PLUTONIUM. Coleman, George H. (Lawrence Radiation Lab., Univ. of California, Livermore). Sept. 1, 1965. Contract W-7405-eng-48. 192p. (UCRL-14289). Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Nuclear Science Series of the National Academy of Sciences–National Research Council, Washington, D. C. Committee on Nuclear Science.

A review is presented on the nuclear and chemical features of Pu and sample dissolution and counting techniques. A collection of radiochemical procedures for Pu is included. 455 references are given for the period through Sept. 1964. (P.C.H.)

**43077** (NP-16214) REMOTELY OPERATED PIPETTING DEVICE FOR USE IN THE EUROCHEMIC ANALYTICAL LABORATORY. Sitte, R.; Vandevelde, G.; Eschrich, H. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). Mar. 1966. 30p. (ETR-179). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A remotely operated pipetting device was developed for the precise delivery of aliquots of highly radioactive solutions inside the shielded boxes of an analytical laboratory. The construction and operation of this remote pipetter and its accessories are described. Tests showed that the precision for pipetted aliquots of 200 $\mu$l and 500 $\mu$l is better than 0.2% (relative standard deviation). (auth)

**43078** (ORNL-3975) ALPHA M: AN IMPROVED COMPUTER PROGRAM FOR DETERMINING RADIOISOTOPES BY LEAST-SQUARES RESOLUTION OF THE GAMMA-RAY SPECTRA. Schonfeld, Ernest (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 44p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Alpha M is an improved version of program Alpha—more versatile, more accurate, and also reduces the cost per determination. Fewer counts per channel are required, variations of the background are compensated for, computation time is reduced, results of consecutive spectra can be added, and initial conditions can be changed. A further improvement over Alpha is that the new program includes instructions for use with FORTRAN II, 62, 63, and IV languages and several digital computers—CDC-1604, -3600, IBM-7094/0, and -360. (auth)

**43079** (ORNL-TM-1590) A SURVEY OF SENSITIVITY LIMITS FOR THE SPECTROGRAPHIC DETERMINATION OF TRACE IMPURITIES IN $U_3O_8$. Feldman, Cyrus (Oak Ridge National Lab., Tenn.). Aug. 10, 1966. Contract W-7405-eng-26. 12p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The sensitivity limits routinely quoted by 15 AEC-connected laboratories for the determination of 65 trace impurities in $U_3O_8$ are presented in tabular form. Separate tables are given for the carrier distillation and chemical pre-concentration + spectrographic techniques. Brief outlines of experimental conditions are also included. (auth)

**43080** (ORO-2670-15) DETERMINATION OF ANTIMONY IN NATURAL MATERIALS BY NEUTRON ACTIVATION. Tanner, James T. (Kentucky Univ., Lexington. Dept. of Chemistry). Sept. 1, 1966. Contract AT(40-1)-2670. 141p. Dep. mn. CFSTI $4.00 cy, $1.00 mn.

Thesis.

The abundance of antimony in 23 chondrites, 8 achondrites, 3 siderites, 5 separated meteoritic phases, 12 tektites, 6 natural glasses, 11 standard rocks, 11 selected terrestrial rocks, and 8 deep-sea sediments was determined by neutron activation analysis. The method used is described. The data confirm the expectation that antimony has appreciable siderophilic and chalcophillic properties in meteoritic matter. The antimony abundances on a weight basis among the ordinary chondrites (average of 0.089 ppM) were found to be very uniform with the maximum variation from the mean for 13 analyses being only approximately a factor of two and the mean deviation less than 20%. The cosmic atomic abundance of antimony was calculated and compared with various reference models. The cosmic atomic abundance for antimony relative to Si = $10^6$ was found to be 0.11 based on the ordinary chondrites, 0.40 based on the Type I carbonaceous chondrites, and 0.20 based on the Type III carbonaceous chondrites. The standard and terrestrial rocks were divided into groups ranging from the most acid to the most basic and the average antimony abundances for each group determined. These antimony abundances compare favorably with recent determinations in the literature. In addition deep-sea sediments from a mid-Pacific core and an Argentine Basin core were analyzed for antimony. Values ranged from 0.36 to 7.03 ppM. The data suggest an increase of antimony concentration with depth for the mid-Pacific core but only a random distribution for the Argentine Basin core. Tektites, natural glasses (Libyan Desert and Darwin glass), and impact glass were also analyzed for antimony. Antimony was found to be enriched in going from west to east in the Australian tektites. (P.C.H.)

**43081** (ORO-2980-13) SEPARATION OF ISOTOPIC INTERFERENCES UTILIZING Ge(Li) GAMMA RAY DETECTORS. Parker, C. V. Jr.; Martin, T. C.; Morgan, I. L. (Texas Nuclear Corp., Austin). July 5, 1966. Contract AT(40-1)-2980. 4p. (CONF-661001-17). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

For Presentation at 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

A method that has proven successful in separating the particularly troublesome interference between the 1.78 Mev gamma ray from $^{28}$Si(n,p)$^{28}$Al and 1.81 Mev gamma ray from $^{56}$Fe(n,p)$^{56}$Mn is presented. A lithium drifted germanium solid state detector is used as a high resolution gamma spectrometer to provide adequate separation between these two gamma rays. After irradiation with 14 Mev neutrons, the samples were counted using a 4.4 cc and 13 cc Ge(Li) detector. The intrinsic photopeak efficiency of the 4.4 cc detector was measured to be 0.18% at 1.80 Mev and the larger detector was found to be about 3 times as efficient. (P.C.H.)

**43082** (PEL–116) NUCLEAR TECHNIQUES IN FORENSIC SCIENCE. An Annotated Bibliography. Rossouw, S. F. (comp.) (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). June 1966. 28p. Dep. mn.

Sixty-eight references on the application of nuclear techniques, especially activation analysis, to scientific crime detection or prevention are given to journals and reports published from Jan. 1960 to June 1966. Subject and author indexes are appended. (P.C.H.)

**43083** (R–66SD3012) POTASSIUM CORROSION TEST LOOP DEVELOPMENT. TOPICAL REPORT NO. 4. PURIFICATION, ANALYSIS AND HANDLING OF SODIUM AND POTASSIUM. Dotson, L. E.; Hand, R. B. (General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section). June 13, 1966. Contract NAS-3-2547. 176p.

Purification systems and handling equipment were designed, built, and operated to provide the alkali metals used in the three corrosion loop systems. The purification methods used were filtration, hot trapping, and vacuum distillation—the latter method being used for potassium only. The handling equipment for Loop I was quite simple and the pressure change technique was used to fill the loop. The handling system for Loop II and the Prototype Loop included charge pots of known volume for filling the loops and utilized oven-heated transfer lines where possible. The sodium, potassium, and eutectic NaK used in the three loop systems was analyzed for oxygen by the amalgamation method and for metallic impurities by emission spectrography. In all cases the alkali metals used in the loops were of the desired purity as determined by the analyses. The hot traps and the still operated as expected with no real problems encountered during operation. A complete set of drawing lists and drawings of the alkali metal purification and handling systems for all three corrosion loops is appended. (auth)

**43084** (TID–23295) THE CHEMISTRY AND ANALYSIS OF TRACE METALS IN SEA WATER. Final Report. Hood, Donald W. (Texas Agricultural and Mechanical Univ., College Station. Dept. of Oceanography and Meteorology). Jan. 31, 1966. Contract AT(40-1)-2799. 163p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Four sections are included; separate abstracts were prepared for each. (P.C.H.)

*For abstracts of individual sections see: 43085–43088.*

**43085** (TID–23295, Sect. 2) STUDIES ON THE DISTRIBUTION OF COPPER, MANGANESE AND ZINC IN THE OCEAN USING NEUTRON ACTIVATION ANALYSIS. Slowey, James Frank Jr. (Texas Agricultural and Mechanical Univ., College Station. Dept. of Oceanography and Meteorology). 113p.

A method using neutron activation analysis was developed for estimating the total elemental concentration of copper, manganese, and zinc in sea water. Application of this method to the analysis of sea water samples collected in various oceanic regions provided vertical and horizontal distribution patterns for these elements in the Gulf of Mexico, Southeastern Pacific Ocean, and Antarctic waters. The range of observed values were: 0.04–12 μg/l for copper, 0.04–19 μg/l for manganese, and 0.21–17.6 μg/l for zinc. In the Gulf of Mexico, highest values were found in coastal waters and at the surface and intermediate depths (500 to 1000 meters) of offshore waters. High values were also found in regions of upwelling in the Southeastern Pacific Ocean. The waters of the Antarctic were characterized by low values for these elements in the middle of Drake Passage. Higher values were found near the Antarctic continent and north of the Antarctic Convergence. Manganese values for the Antarctic were the lowest found in any oceanic region. Additional studies were made on samples from the Gulf of Mexico to determine the significance of particulate, ionic, and nondialyzable forms of copper, manganese, and zinc to the total amount of each metal present in sea water. (auth)

**43086** (TID–23295, Sect. 3) NEUTRON ACTIVATION ANALYSIS OF RUTHENIUM IN SEA WATER. Dixon, Bryan W.; Slowey, J. Frank; Hood, Donald W. (Texas Agricultural and Mechanical Univ., College Station. Dept. of Oceanography and Meteorology). 22p.

A thermal neutron activation analysis method was developed for ruthenium which has a sensitivity of 0.03 μg with a precision of about 10%. Sea water samples of 760 l for the soluble fraction and 1520 l for the particulate fraction were collected at several locations and depths in the Gulf of Mexico. The $^{96}$Ru isotope with 5.5% abundance was used to produce $^{97}$Ru with a 2.9 d $T_{1/2}$ for the analysis. Soluble Ru (passed through 0.45 μ filter) values were found to range around $7 \times 10^{-4}$ μg/l and the particulate fraction about one order of magnitude less. Concentrations were found highest in coastal waters and in the open sea, higher values were found at the surface than at depth. The limiting factor in Ru concentration does not appear to be solubility but is probably associated with particle exchange phenomenon. (P.C.H.)

**43087** (TID–23295, Sect. 4) RARE EARTH DISTRIBUTION IN WATERS OF GULF OF MEXICO. Hayes, D. W.; Slowey, J. F.; Hood, D. W. (Texas Agricultural and Mechanical Univ., College Station. Dept. of Oceanography and Meteorology). 12p.

The rare earth samples were separated from impurities, such as Th and U, treated according to whether they were soluble or particulate fractions, activated, and separated by ion exchange by eluting with alpha-hydroxyisobutyric acid. The particulate fraction is defined as the material retained by a 0.45 μ Millipore filter. The rare earths appear to occur mainly in the soluble form. The particulate to soluble (P/S) ratios were lower than those previously reported for sea water in the Indian Ocean. The P/S ratio was smaller for the heavier rare earth elements than for the lighter ones indicating that the particulate phase may be functional in the fractionation of the rare earth elements in sea water. (P.C.H.)

**43088** (TID–23295, Sect. 5) ZIRCONIUM ANALYSIS OF SEA WATER. Hedges, Dorothea H.; Hood, Donald W. (Texas Agricultural and Mechanical Univ., College Station, Dept. of Oceanography and Meteorology). 8p.

Analysis of sea water for zirconium using coprecipitation concentration, ion exchange column separation, and spectrophotometric analysis was found to be feasible. The method is valuable in that it allows multiple element analyses on large single samples of sea water. The results indicated an overall efficiency of 95–100%. (P.C.H.)

**43089** (Y–1175(Del.)) THE FALLING DROP DENSITY ANALYSIS FOR RELATIVE CONCENTRATIONS OF HYDROGEN AND DEUTERIUM IN LITHIUM DEUTERIDE. Cofield, R. E.; Paterson, J. E.; Rowan, J. H. (Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant). Sept. 5, 1956. Contract W-7405-eng-26. 35p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The falling drop density analysis, measuring the variation of specific gravity of water samples with variation in ratio of hydrogen isotope concentrations, was applied to the determination of relative hydrogen isotope abundance in lithium deuteride. The method includes the decomposition and treatment of LiD samples to yield heavy water, and the analysis for hydrogen isotope concentration in the water. The method was found to be simple to operate, fairly rapid, sufficiently accurate, and inexpensive. Results of analyses of samples indicate a precision of ±0.087 mole per cent D at the 99 mole per cent D level. (auth)

**43090** (TID–23342) PURIFICATION AND CRYSTALLIZATION OF AMORPHOUS BORON POWDER; RECOVERY AND PURIFICATION OF BORON FROM RESIDUES AND SCRAP. Technical Report, July 1, 1965–June 30, 1966. Musgrave, John R.; Starks, Ralph J.; Erwin, Harold E.; Buford, John T.; Biggerstaff, George E. (Eagle-Picher Co., Miami, Okla.). Contract AT(40-1)-3327. 29p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Methods for purifying and crystallizing amorphous boron-10 in quantities sufficient for evaluation were developed. Sintering of isostatic compacts gives good crystallinity and improved purity, although it does not remove the bulk of metallic impurities. Horizontal zone refining gives good crystallinity, high purity, and a marked reduction in metallic impurities. Processing of scrap material is described which results in a crystalline, high purity material with only a small amount of metallic impurities. (auth)

**43091** (UCRL–14879) DETERMINATION OF IMPURITIES IN ELEMENTAL BORON BY X-RAY FLUORESCENCE. **Rigdon, Lester P.** (Lawrence Radiation Lab., Univ. of California, Livermore). **Aug. 11, 1966.** Contract W-7405-eng-48. 9p. (CONF-661008–2). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 1st Materials Research Symposium on Trace Characterization: Chemical and Physical, Gaithersburg, Md.

An x-ray fluorescence technique was developed for the determination of Br, Ca, Cl, Cu, Fe, and Ni in elemental boron. Significant segregation of impurities in elemental boron may occur, even in a sample of a few grams. However, samples prepared with jet-milled boron and a graphite matrix are homogeneous and analyses are reproducible to a few percent relative standard deviation. Standards for the x-ray fluorescence analysis of Br, Ca, Cl, Cu, Fe, and Ni may be prepared by addition of standard solutions to a graphite matrix. X-ray instrumentation parameters and comparative analytical results are presented. (auth)

**43092** (Y–1553) PURIFICATION OF CONCENTRATED LITHIUM CHLORIDE SOLUTION BY THE OXINE PRECIPITATION-CARBON ADSORPTION METHOD. **Dietrich, W. C.** (Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant). **Oct. 4, 1966.** Contract W-7405-eng-26. 15p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A batch method to purify concentrated lithium chloride solutions was developed. Potassium is precipitated as potassium tetraphenylborate, calcium is adsorbed by alumina, and other foreign cations are removed by oxine precipitation and carbon adsorption. (auth)

**43093** (BNL-tr–84) SEPARATION COEFFICIENTS OF $^{12}$C AND $^{14}$C BY EQUILIBRIUM EVAPORATION OF METHANE. **Uvarov, O. V.; Sokolov, N. M.; Lyapin, V. V.; Zhavoronkov, N. M.** Translated by Stephen J. Amoretty (Brookhaven National Lab., Upton, N. Y.), from Zh. Vses. Khim. Obshest. Im. D. I. Mendeleeva, 7: 695-7(1962). 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.10 fs, $0.80 mf.

Radiometric examination of the results of equilibrium evaporation of $CH_4$ as a means of separating $^{12}$C and $^{14}$C isotopes gave the separation coefficient 1.0246. The difference in heats of vaporization of $^{12}CH_4$ and $^{14}CH_4$ is 5.2 cal/mole. (auth)

**43094** COMPARISON OF NEUTRON MODERATION AND GRAVIMETRIC SAMPLING FOR SOIL-MOISTURE DETERMINATION WITH EMPHASIS ON THE COST FACTOR. **Cohen, O. P.; Tadmor, N. H.** (Volcani Inst. of Agricultural Research, Rehovoth, Israel). Agr. Meteorol., 3: 97-102(**Feb. 1966**).

Soil-moisture measurements were made in the same plots 12 times in one yr by the neutron-moderation technique and gravimetric sampling. A cost comparison between the two methods indicated that investment in neutron-moderation equipment was repaid in a 2-yr period by savings on labor alone. Sampling by the gravimetric method necessitated two teams of two men each, while the neutron-scattering equipment required only one man. The total annual cost for soil-moisture sampling by the gravity technique was $2,391 and by neutron-scattering techniques, $384. The within-plot coefficient of error for three gravity samples compared to measurements in two neutron-moderation access tubes was 13.63% and 6.29%, respectively. (BBB)

**43095** REACTIVITY AND POSSIBLE APPLICATIONS OF IMIDODIOXIMES: MALEIMIDE DIOXIME AND 1,2,3,6-TETRAHYDROPHTHALIMIDE DIOXIME. **Buscarons, F.; Iturriaga, H.** (Univ., Barcelona). An. Real Soc. Espan. Fis. Quim. (Madrid), Ser. B, 62: 601-10(Apr.-May 1966). (In Spanish).

Analytical applications of maleimide dioxime and 1,2,3,6-phthalimide dioxime were studied and their reactivities compared. Sensitivities are given for a number of qualitative reactions. (auth)

**43096** SCINTILLATION SPECTROMETRY: THE STATE OF THE ART. **Kaiser, William C.** (Argonne National Lab., Ill.). Anal. Chem., 38: 27A-40A(**Oct. 1966**).

Present uses of, and instrumentation involved with, scintillation spectrometry are described. Special attention is given to scintillator materials, advances in photomultiplier tubes, and improvements in resolution. Applications of organic scintillators and future developments are also discussed. (auth)

**43097** USE OF CHARGED PARTICLES FROM A 2-MEGAVOLT VAN DE GRAAFF ACCELERATOR FOR ELEMENTAL SURFACE ANALYSIS. **Anders, Oswald U.** (Dow Chemical Co., Midland, Mich.). Anal. Chem., 38: 1442-52(**Oct. 1966**).

A method applicable to both qualitative and quantitative analyses using protons, deuterons, and $He^+$ particles from an accelerator was developed. As little as 9 $\mu g/cm^2$ of silver and 15 $\mu g/cm^2$ of chromium were determined. Errors were in the range of 4%. The charged-particle products induced in low-atomic number elements with deuterons were found to be suited for identifying the target element and their surface concentrations. Comparative studies involved samples of thin PVC–PVA copolymer films, films coated with thin lead deposits, chromate-pickled magnesium pieces, plastics, metals, and rocks. (auth)

**43098** AN IMPROVED DESCRIPTION OF SEPARATION AND PERFORMANCE CAPABILITIES OF LIQUID SCINTILLATION COUNTERS USED IN DUAL ISOTOPE STUDIES. **Klein, Peter D.; Eisler, William J. Jr.** (Argonne National Lab., Ill.). Anal. Chem., 38: 1453-7(**Oct. 1966**).

A figure of merit for liquid scintillation counters, expressing their ability to separate two beta spectra and thus to determine the concentrations of each isotope was derived. This separation efficiency was used to describe scintillation counters in an over-all performance number, which is the product of the separation efficiency and each of the two isotope-detection efficiencies at the point of optimum separation. The pure beta spectra of tritium and radiocarbon are used to predict the limiting performance numbers attainable in counter design and these numbers are compared with several examples obtained from commercial counters now on the market. (auth)

**43099** VOLTAMMETRY AND RELATED STUDIES OF URANIUM IN MOLTEN LITHIUM FLUORIDE–BERYLLIUM FLUORIDE–ZIRCONIUM FLUORIDE. **Mamantov, Gleb; Manning, D. L.** (Oak Ridge National Lab., Tenn.). Anal. Chem., 38: 1494-8(**Oct. 1966**). (ORNL-P–2233).

Electrochemical reduction and oxidation of U(IV) in $LiF-BeF_2-ZrF_4$ (64-34-1.8 mole % and 65-29-5 mole %; the latter composition is used as the solvent for $UF_4$ in the molten salt-reactor experiment) were investigated by voltametry, chronopotentiometry, and chronoamperometry in the temperature range from 480 to 620°C. Platinum, graphite, molybdenum, tungsten, and tantalum were used as electrodes. At 500°C the reduction of uranium(IV) at platinum is a reversible, one-electron process. Well-defined and reproducible voltammograms and chronopotentiograms were obtained at concentrations as high as 0.8 mole % $UF_4$. The diffusion coefficient of U(IV) at 500°C was calculated as $2 \times 10^{-6}$ cm$^2$/sec; the activation energy for diffusion was found to be 11 kcal/mole. The results obtained provide the basis for an in situ electroanalytical method for the determination of uranium in molten fluorides. (auth)

**43100** SPECTROPHOTOMETRIC INVESTIGATION AND ANALYTICAL APPLICATION OF THE SYNERGIC SOLVENT EXTRACTION OF RARE EARTHS WITH MIXTURES OF 2-THENOYLTRIFLUOROACETONE AND TRI-n-OCTYL PHOSPHINE OXIDE. **Taketatsu, Tomitsugu; Banks, Charles V.** (Iowa State Univ., Ames). Anal. Chem., 38: 1524-8(**Oct. 1966**). (IS–1378).

The absorption spectra of rare earth–TTA–TOPO complexes, that were synergically extracted into toluene from an aqueous solution, were measured from 430 through 800 mμ. One absorption band each for neodymium, holmium, and erbium was remarkably enhanced and the molar absorptivities at the wavelengths of maximum absorption were about 7, 26, and 22 times greater, respectively, than the same quantities in chloride medium. The formulas of these complexes were estimated spectrophotometrically to be Ln(TTA)$_3$ · TOPO and Ln(TTA)$_3$ · 2TOPO. The spectrophotometric determination of neodymium, holmium, and erbium was investigated using the analytically significant absorption bands at 584.1, 451.8, and 520.2 mμ, respectively. (auth)

**43101** COMPARATIVE CONDENSATION PRESSURE ANALYZER FOR URANIUM HEXAFLUORIDE PURITY. **Pappas, W. S.; MacIntyre, S. A.; Weber, C. W. (Oak Ridge Gaseous Diffusion Plant, Tenn.). Anal. Chem., 38: 1570-3(Oct. 1966). (K-L-6095).**

A simple pneumatic analyzer was developed for continuous purity determination of vapor streams. The condensation pressure of the impure sample stream is automatically compared to the vapor pressure of a pure sample at the same temperature. The comparative instrument provides a more sensitive and accurate measurement than can be obtained by direct condensation pressure methods. A prototype model analyzer gave several years of trouble-free service where it is used to monitor the purity of a uranium hexafluoride system. A standard deviation of ±0.014 mole % uranium hexafluoride was attained. The pneumatic response can be fed to a control valve for process control. (auth)

**43102** APPLICATION OF PHOTOACTIVATION TO THE DETERMINATION OF GERMANIUM IN TITANIUM. **Abe, Shigeki (Yamagata Univ., Yonezawa, Japan). Anal. Chem., 38: 1622-3(Oct. 1966).**

A nondestructive method for the determination of germanium in titanium was developed using photoactivation with a 20-Mev linear electron accelerator. The method is based on counting the $^{69}$Ge activity in relation to the $^{47}$Sc activity. A linear relation between the photopeak activity ratio of $^{69}$Ge/$^{47}$Sc and the Ge/Ti weight ratio was noted. The method is efficient for a lower limit of 0.1% Ge in Ti. The presence of Zr interfered with the analysis. (P.C.S.)

**43103** THEORETICAL EVALUATION OF GAS CHROMATOGRAPHIC ISOTOPIC EXCHANGE AND COLUMN EFFICIENCY. **Tadmor, Jacob (Israel Atomic Energy Commission, Yavne). Anal. Chem., 38: 1624-5(Oct. 1966).**

Experiments were performed to determine whether theoretical calculations could predict the volume of chromatographic column necessary for obtaining a certain isotopic exchange percentage at a given flow rate. Graphical data and equations are presented showing a linear relation between volume and gas-flow rate. Standard deviation of the data was ±17%. (P.C.S.)

**43104** SEMIQUANTITATIVE PROCEDURE FOR THE SIMULTANEOUS SPECTROGRAPHIC DETERMINATION OF THIRTY ELEMENTS IN POWDER SAMPLES. de Villiers, Daphne B.; van Wamelen, Diana; Strasheim, A. (Council for Scientific and Industrial Research, Pretoria). **Appl. Spectros., 20: 298-301(Sept.-Oct. 1966).**

A semiquantitative procedure for the simultaneous determination of a large number of elements in powder samples is described. Use is made of rapid evaporation of the samples in a controlled oxygen-argon atmosphere. Line intensities are estimated visually. (auth)

**43105** SIMULTANEOUS DETERMINATION OF CALCIUM, LITHIUM, AND POTASSIUM IN HIGH-PURITY THORIUM DIOXIDE. Nelms, J. R.; Vogel, R. S. (Mallinckrodt Chemical Works, Saint Charles, Mo.). **Appl. Spectros., 20: 339(Sept.-Oct. 1966).**

A method for routine spectrographic determination of low concentrations of Ca, Li, and K in ThO$_2$ was developed using a filter to remove interference bands. The calibration range of the elements in ThO$_2$ is: Ca, 10 to 250; K, 10 to 100; and Li, 0.5 to 5 ppM. (P.C.S.)

**43106** MEASUREMENTS OF ACTIVITY OF RADIOACTIVE GASES BY MEANS OF SPHERICAL IONIZATION CHAMBER. **Bazhenov, V. A.; Bochkarev, V. V.; Golubev, Yu. M.; Levin, I. V.; Sokolova, T. N.; Turkin, A. D. At. Energ. (USSR), 21: 141-2(Aug. 1966). (In Russian).**

A spherical, 24-cm ionization chamber with a copper barrier, filled with air under atmospheric pressure and operating in the β-spectrum energy range (0.15 to 2.20 Mev) was used for measuring the gas activity in experiments with $^{133}$Xe, CO$_2$ (labeled with $^{14}$C), $^{131}$Xe, $^{85}$Kr, and $^{14}$Ar gases. The gas activity was determined by means of compensation counters. The order of error was about 2.5%. The results showed that only $^{14}$C, $^{85}$Kr, and $^{41}$Ar with simple β spectra could be used, while $^{133}$Xe and $^{131}$Xe, with their conversion electrons, could not be used. The average current magnitudes $\underline{K}$ per particle in the chamber were correlated with the theoretical values and the results agreed within 25 to 30%. (R.V.J.)

**43107** THE CHEMISTRY OF BERYLLIUM. **Krejci, L. E.; Scheel, L. D. pp 45-131 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.**

The chemical and physical properties and natural occurrence of beryllium are reviewed. The primary factors determining the stable states are emphasized. (523 references.) (C.H.)

**43108** ANALYTIC DETERMINATION OF BERYLLIUM. **Keenan, Robert G. pp 133-65 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.**

Methods for the analytical determination of Be are described with emphasis on direct and specific methods for the analysis of Be in materials of commercial importance. Methods for the concentration of Be and separation prior to spectrographic analysis, which is necessary for certain types of samples such as human body tissues and urine samples, are also described. A tabulation of chemical methods along with their individual applications is included. (64 references.) (C.H.)

**43109** DETERMINATION OF NITROGEN IN URANIUM NITRIDES BY THE DUMAS AND KJELDAHL METHODS. **Takahashi, Yasuo (Inst. of Physical and Chemical Research, Tokyo). Bunseki Kagaku, 14: 939-45(Oct. 1965). (In Japanese).**

An investigation was made of the experimental conditions under which the Dumas and Kjeldahl procedures are applied to the determination of nitrogen in uranium nitrides. For the Dumas method a study was made of an oxidizing agent and the evolution of nitrogen. The optimum conditions were determined as follows: sample, 70 to 100 mg; oxidizing agent, 1.5 g of CuO or AgMnO$_4$ decomposition product; CO$_2$ flow rate, 5 ml/min; heating period, 70 min; and heating temperature, 850°C. The standard deviation by this method is 0.03% for N$_2$ contents of 5 to 9%. For the Kjeldahl method, 80 to 130 mg of sample was added to 5 ml H$_2$SO$_4$ and 100 mg H$_2$SeO$_4$, SeOCl$_2$, or SeO$_2$ as a catalyst. The standard deviation by this method is 0.03% for the N$_2$ contents of 5 to 9%. The nitrogen contents determined by both methods give the same values. In the determination of N in the UN phase, the Kjeldahl method gave values approximately 5% lower than by the Dumas method. (NSA of Japan)

**43110** SPECTROPHOTOMETRIC DETERMINATION OF YTTRIUM WITH CHROMAZUROL S. **Ishida, Ryoei (Hokkaido Gakugei Univ., Hakodate, Japan). Bunseki Kagaku, 15: 829-34(Aug. 1966). (In Japanese).**

The reaction of Chrome azurol S with yttrium to form a reddish violet complex in a nearly neutral medium (Barbital sodium-hydrochloric acid buffer) was used for determining yttrium. Several conditions for the color development, the composition of the colored complex, and the influence of coexisting ions were investigated. The maximum absorption wavelength of the complex against the reagent blank at about pH 7.0 or higher was 562 mμ. Absorption curves against water blank at pH 7.6 have an isosbestic point at about 487 mμ which depends on the amount of reagent. The optimum pH for the color development is at about 7.6. A linear relationship exists between the absorbance and the yttrium concentration (Beer's law). The optimum concentration range determined by Ringbom's plot is between 6 and 35 μg of yttrium in 10 ml. The molar extinction coefficient of the complex at 562 mμ is 22,600. The molar ratio of yttrium and Chromazurol S in the complex is estimated to be 1 : 2 by a continuous variation method and by a mole ratio method. The complex has a formation constant of $1.5 \times 10^{10}$ under the conditions studied. Anions such as phosphate, EDTA, fluoride, oxalate, tartrate, etc., inhibit the color development, and cations such as Be(II), $UO_2$(II), etc., give an overestimation of yttrium. Several heavy metals precipitate under the conditions and interfere with the determination. (auth)

**43111** DETERMINATION OF OXYGEN IN TITANIUM METAL BY A FAST NEUTRON ACTIVATION METHOD. Fujii, Isao; Muto, Haruo (Tokyo Shibaura Electric Co., Kawasaki, Japan). Bunseki Kagaku, 15: 856-8(Aug. 1966). (In Japanese).

The oxygen content of titanium metal was determined by bombarding samples with 14 Mev neutrons from a Cockcroft-Walton machine and measuring the 7.35-sec nitrogen-16 gamma activity produced by the reaction $^{16}O(n,p)^{16}N$. Optimum conditions for the measurement of gamma rays of $^{16}N$, and correction for the absorption of gamma rays by samples are discussed. The analytical results by this method are in good agreement with those by the vacuum fusion method. The sensitivity for oxygen is about 1000 counts/mg of oxygen and the standard deviation of the method at the level of oxygen concentration 0.1% is 4%. (auth)

**43112** QUANTOMETRIC ANALYSIS OF RARE EARTH ELEMENTS IN MAGNESIUM ALLOYS. Sano, Sadao; Matsui, Hiroshi; Nakagawa, Ryozo (Industrial Research Inst. of Kanagawa Prefecture, Kawasaki, Japan). Bunseki Kagaku, 15: 858-60(Aug. 1966). (In Japanese).

Using ARL's 1.5 m Industrial Research Quantometer, analyses of rare earth elements and zirconium in magnesium alloys were carried out by the point-to-plane method. High voltage spark discharge (L = 360 μH, C = 0.007 μF, R = residual, V = 20 kV) was used for excitation. Elements analyzed and the range of their concentration were: La 0.06–1.4%, Ce 0.04–1.9%, Pr 0.16–0.5%, Nd 0.4–3.5%, and Zr 0.4–0.7%. The coefficient of variation was 1–3%. (auth)

**43113** METHOD FOR THE DETERMINATION OF WATER IN NONPOLAR LIQUIDS; THE SOLUBILITY OF WATER IN BENZENE. Moule, D. C.; Thurston, W. M. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Chem., 44: 1361-7(1966). (AECL-2433).

A method is described for the analysis of water in nonpolar organic liquids. It is based on an isotope dilution procedure and involves the exchange of the water present in the sample with $D_2O$. The change in isotopic composition of the $D_2O$ is determined by infrared-difference spectroscopy. The method appears to be accurate to ±0.8%. The principal advantage of this method is that the difficult problem of calibration with organic-water standards is avoided. It is restricted, however, to solvents that have a low solubility in water and do not have exchangeable hydrogens. A series of solubility measurements was carried out for $H_2O$ in $C_6H_6$ from 10 to 60°C. The data were fitted to the usual interpolation equation $\ln(f/x) = -A/T + B \ln T + C$, and the thermodynamic functions of solution, $\Delta G$, $\Delta H$, $\Delta C_p$, and $\Delta S$, were computed for the transfer of 1 mole of water from the benzene phase to the vapor phase. (auth)

**43114** DETERMINATION OF RADIOCHEMICAL PURITY OF SODIUM CHROMATE $^{51}Cr$ INJECTIONS BY THIN-LAYER CHROMATOGRAPHY. Burianek, J. (State Inst. for Drug Control, Prague). Cesk. Farm., 15: 130-3 (Mar. 1966). (In Czech).

Sodium chromate may contain the radiochemical impurity $^{51}Cr^{3+}$ resulting from radiation reduction. A method was developed for determination of this impurity by thin-layer chromatography, using as solvent a mixture of water-ethanol-ammonia, 125 : 50 : 25. Ethanol may be replaced by acetone. Silica gel, siliceous earth, or cellulose were suitable adsorbents. The ratio of the chromate to chromic ions was measured by a gamma scintillation counter after separation. (JPRS)

**43115** THE DETERMINATION OF CARBON, NITROGEN, AND OXYGEN AND THEIR STABLE ISOTOPIC TRACERS IN GASES BY NEUTRON TIME-OF-FLIGHT SPECTROSCOPY. Peisach, Max (Southern Univ. Nuclear Inst., Faure, S. Afr.). Chem. Commun., No. 18, 632-3 (Sept. 21, 1966).

Neutron time-of-flight spectroscopy was studied as a nondestructive method for the determination of C, N, and O by deuteron irradiation and of the stable tracers $^{13}C$, $^{15}N$, $^{17}O$, and $^{18}O$ by proton irradiation. As only a few mm pressure is required, liquids with vapor pressure of this order can be analyzed provided their vapors can withstand the high temperature. Relative standard deviation is ±3%. (P.C.S.)

**43116** NEUTRON RADIOACTIVATION DETERMINATION OF SULFUR AND SOME OTHER ELEMENTS PRESENT IN CARBAZOLE PURIFIED BY ZONE MELTING. Blouri, Julienne; Chaudron, Thierry; Albert, Philippe (CNRS, Val-de-Marne, France). Compt. Rend., Ser. C, 263: 290-2(July 25, 1966). (In French).

To determine traces of sulfur and to investigate some other elements in samples of carbazole, purified by the method of zone melting, the determination of these elements by radioactivation using thermal neutrons was studied. The determination of amounts of Na, Cu, Sb, Mn, Cr, and Zn in the order of several parts per million was made. (tr-auth)

**43117** MEASUREMENT OF $^{45}Ca$ IN SERUM BY LIQUID SCINTILLATION. Kumar, M. Ashwini (Univ. of Toronto). Int. J. Appl. Radiat. Isotop., 17: 556-7(Sept. 1966).

A simple method for measuring $^{45}Ca$ in serum or extracellular fluids without preliminary preparation is described. Dilutions of $^{45}Ca$ of high specific activity were made in water, Krebs' solution, human and rat serums. Scintillators of various compositions gave varying counting efficiencies. Standard deviation was 1% or less. (J.G.B.)

**43118** ISOTOPIC METHOD FOR DETERMINING ENZYME ACTIVITY IN MICROGRAM AND SUBMICROGRAM QUANTITIES OF TISSUE. McCaman, Richard E. (Indiana Univ., Indianapolis). Isotop. Radiat. Technol., 3: 328-34; 337-8(Summer 1966).

The isotopic method for determining enzyme activity is reviewed, and representative protocols are presented. The enzyme preparation is incubated with a radioisotope-labeled substrate, and the radioactivity of the isolated reaction product is measured. The methods generally have sensitivity of $10^{-12}$ mole of enzyme product when the substrates have a specific activity of 10 mC/mmole. It is suggested that these techniques may be applicable to metabolic studies at the single-cell level. (auth)

**43119** GAMMA ACTIVATION ANALYSIS OF ROCKS AND ORES. Gerrard, Martha. Isotop. Radiat. Technol., 3: 334-7; 338-9(Summer 1966).

A survey of USSR work on gamma activation analysis indicated this to be a promising technique for analyzing rocks and ores. Samples to be analyzed are irradiated in the bremsstrahlung beam produced by a betatron, and the induced activities are determined. The use of bremsstrahlung of different energies and selective recording of the activities permit rapid analysis of very complex materials. (auth)

**43120** DETERMINATIONS OF CONTENTS IN TERNARY SYSTEMS BY MEASURING THE BACKSCATTERING OF SECONDARY ELECTRONS AND BETA-PARTICLES. Thuemmel, H.-W.; Bauerfeind, G. (Institut fuer Angewandte Radioaktivitaet, Leipzig). Isotopenpraxis, 2: 1-7(Jan. 1966). (In German).

The beta backscatter technique in general allows determination of only the contents in binary systems; combining it with other non-spectrometric methods also not suitable for directly determining the different elements contained in the sample makes it possible to determine the contents in polynary systems. The relation of measuring backscattered beta radiation to the measurement of backward-emitted $\gamma$-secondary electrons is discussed for determining the contents of elements in ternary systems. This method was chosen because of advantages in sample preparation. (auth)

**43121** RADIOMETRIC DETERMINATION OF THE $K_2O$ CONTENT BY USING A SCINTILLATION COUNTER. **Philipp, J. (VEB Vakutronik WIB, Dresden). Isotopenpraxis, 2: 14-16(Jan. 1966). (In German).**

Using a scintillation counter with a $K_2O$ measuring apparatus guarantees exact and continuous determination of the $K_2O$ content of various products. The powerful output signal allows the connection of an automatic controller. The investment cost of the gage may be amortized in a short time due to an increase in $K_2O$ yield. (auth)

**43122** REAGENTS FOR THE QUALITATIVE ANALYSIS OF Ce(III)-Ce(IV) MIXTURES. **Lal, Sudarshan; Srivastava, S. N. (Agra Coll., India). J. Chem. Educ., 43: 424(Aug. 1966).**

Comparisons are made between the behavior of Ce(III) and Ce(IV) toward several common analytical reagents. With thymol blue, Ce(IV) gives a pink coloration which is readily extractable by ether into a pink upper layer; Ce(III) gives a yellow solution which is not extractable by ether. The test is applicable both on micro and semimicro scales. With tartrazine, Ce(IV) gives a brownish yellow precipitate. The minimum amount of Ce(IV) is about $5 \times 10^{-3}$ g/ml; a lower concentration than this limit will not yield an observable precipitate of Ce(IV). Ce(III) does not form a precipitate. With alizarin, Ce(III) yields a pink color and Ce(IV) a yellow color. Favorable results are obtained by spot test analysis where alcoholic or aqueous media are required. With selenious acid, Ce(IV) yields a yellow-brown precipitate in aqueous solution, while Ce(III) fails to yield any precipitate. Ce(IV) can be completely removed and Ce(III) in the filtrate can be detected as a white gelatinous precipitate by the addition of NaF. With potassium bromate, Ce(IV) gives a yellowish-white precipitate in neutral or slightly acidic medium; Ce(III) does not yield any precipitate. Ammonium molybdate gives a yellow precipitate with Ce(IV) and a slight turbidity with Ce(III). The yellow precipitate in the first case is insoluble in 50% acetic acid, while the turbidity disappears in the presence of acetic acid in the latter instance. (BBB)

**43123** APPLICATION OF A MAGNETIC MASS SPECTROMETER TO IONIZATION STUDIES IN IMPURE SHOCK-HEATED ARGON. **Sturtevant, B. (California Inst. of Tech., Pasadena). J. Fluid Mech., 25: 641-56(Aug. 1966).**

A study of the unique role of impurities in the initial stages of ionization relaxation in shock-heated argon, using a sampling mass spectrometer to determine the ionic products of the reaction, is described. The ions are extracted from the shock tube through a small orifice in the end wall after they have diffused through the dense thermal layer adjacent to the wall from the ionizing gas behind the reflected shock wave. The ion diffusion is analyzed in detail to assess the possibility that the sampling process alters the reaction products. It is shown that this is unlikely because the impurities are in dilute concentration and the reaction is studied in its initial stages. This mode of sampling is compared with others. The experiments were conducted in argon at temperature of 16,600°K and pressure of 16 mm Hg with an estimated impurity level of 300 parts per million. A surprisingly large number of different ions were detected during the initial stages of ionization. $O^+$ and $H^+$ were found in much greater amounts than any of the other products, each being about five times more abundant than $Ar^+$. The results suggest that $H_2O$ is probably quite generally the most important impurity in thermal-ionization experiments, and that ionization "incubation" is due to dissociation of molecular impurities (especially $H_2O$) before ionization commences. Possible explanations of the well-known efficiency of small amounts of impurities in initiating ionization are discussed. (auth)

**43124** METHOD FOR MEASUREMENT OF THE RADIOACTIVITY OF WATER. **Charruyer, J.; Saumande, P. J. Med. Bordeaux Sud-Ouest, 138: 998-1002(Aug. 1961). (In French).**

A rapid technic for measurement of radioactivity in natural water from granitic beds involves precipitation of barium sulfate, rapid filtration on a bacteriology-type filter, and counting of radioactivity retained on the precipitate by a thin-window (1 mg/cm$^2$) G-M counter. The method was applied to natural waters of the Department de la Haute-Vienne, and was found to give results comparable with more complicated technics. Rainwater gave radioactivity levels of 12,300 cpm/500 ml by this method. It was possible to detect radioactivities as low as $0.4 \times 10^{-9}$ C/l with the method described. The procedure depends largely on the adsorption of Rn on the barium sulfate precipitate. (BBB)

**43125** A SILICA GEL CHROMATOGRAPHIC PROCEDURE ADAPTED TO LIQUID-SCINTILLATION COUNTING OF $^{14}$C-LABELED ORGANIC ACIDS FROM PLANT MATERIAL AND SILAGE. **Lessard, J. R. (Animal Research Inst., Ottawa); McDonald, P. J. Sci. Food Agr., 17: 257-63(June 1966).**

A technic is described for the extraction of organic acids from plant material and for their separation by silica-gel chromatography in a form suitable for $^{14}$C-liquid scintillation counting. The method consists of cold extraction with dilute sulfuric acid followed by purification of the extract on a silica gel column. The organic acids in the purified extract were separated quantitatively using a continuous gradient-elution system of eluents through a small silica gel column. The extraction method was found to be more efficient for extracting citric, oxalic, and fumaric acids from red clover than a standard method with ethanol, water, and ion-exchange resins. Most of the acids of the tricarboxylic acid cycle were detected in red clover. An unidentified acid accounted for more than 37% of the organic acidity. The activity of $^{14}$C-labeled acids could be measured directly on the eluate from the column in a benzene–butanol solvent system in combination with a liquid scintillation system. (BBB)

**43126** PAPER ELECTROPHORESIS METHOD FOR STUDYING CHEMICAL FORMS OF $^{131}$I IN CARRIER-FREE PREPARATIONS. **Nagy, Agnes G. (Magyar Tudomanyos Akademia Koezponti Fizikai Kutato Intezete, Budapest). Magyar Kem. Foly., 72: 274-9(June 1966). (In Hungarian).**

A paper electrophoresis method was developed for the quantitative and qualitative analysis of chemical forms of a carrier-free $^{131}$I preparation with a high specific activity. Chemical forms and chemical transformations produced by the changes of pH in the solution by the presence of oxygen, by the effects of light, and by ionizing radiation were studied. It is shown that the chemical behavior of iodine in ultra-micro-concentrations differs from iodine behavior in macro-concentration solutions. Parameters were found for certain $^{131}$I chemical forms, which could be retained for an intensive period of time. (R.V.J.)

**43127** PROTON MICROANALYSIS. **Mak, Bing Kwong (Univ. of New South Wales, Kensington); Bird, J. R.; Sabine, T. M. Nature, 211: 738-9(Aug. 13, 1966).**

Charged-particle analysis, using a small-diameter proton beam to induce nuclear reactions, permits nondestructive measurements to be made, particularly for light elements, which are often difficult to detect by other methods. The degree of homogeneity of thin foils of $\alpha$-Ti–O systems was determined by investigation of the oxygen concentration using the $^{18}O(p,\alpha)^{15}N$ reaction. By using 0.86-Mev protons, a dominant resonance was observed in the $\alpha$ yield and the cross section was sufficiently high to offset the ion natural abundance of $^{18}$O. A statistical accuracy of from 2 to 5% was obtained, depending on oxygen concentration. (M.C.G.)

**43128** COMBUSTION OF SAMPLES FOR LIQUID SCINTILLATION COUNTING. **Ragland, James B. (Univ. of Tennessee, Memphis). Nucleus (Chicago), No. 20, 1-11 (Jan. 1966).**

The conventional combustion methods, wet, sealed-tube, oxygen-train, oxygen bomb, and oxygen flask are all discussed from the standpoint of use for combustion of biological samples containing $^{14}$C, tritium, $^{35}$S, or $^{32}$P for determination by liquid scintillation counting. The methods are also suitable for double-labeled samples with two $\beta$ emitting isotopes. In some cases, the combustion products containing the isotopes can be separated and counted individually; while for other mixtures they are best counted combined, counted again after separation of one component to be determined, and the second emitter determined by difference. (B.L.M.)

**43129** DETERMINATION OF RADIORUTHENIUM IN URINE. Bhaindarkar, J. R.; Kamath, P. R. (Atomic Energy Establishment, Trombay, India). pp 27-32 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Urinary ruthenium was estimated by direct oxidation of wet urine with acid $KMnO_4$ in a distillation setup to prevent the loss of Ru on addition of the oxidant. Preliminary oxidation of organic matter in urine and other biological materials was carried out by treatment with nitric acid and hydrogen peroxide to prevent frothing and boil-over in the distillation setup. The urine was first heated with the nitric acid–peroxide mixture and then heated further to volatilize $RuO_4$ by permanganate oxidation. Data are included on carrier and $^{106}$Ru activity exchange in urine. (P.C.S.)

**43130** STUDIES ON CESIUM SORPTION PROPERTIES OF SOME INDIAN VERMICULITES. Jha, J. C.; Chinoy, A. R.; Thomas, K. T. (Atomic Energy Establishment, Trombay, India). pp 40-5 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The possibility of analytical separation of cesium from strontium by cesium sorption by vermiculite was studied and the following observations were noted. At pH 2, there was a very wide gap between the sorption of cesium and strontium. Sorption of cesium was enhanced due to edge fixation by biotite impurities usually present in vermiculite. Interlayer space of vermiculite was too great to restrict exchange with other cations, but the collapsed lattice combined with interlayer exchange sites surrounded by a hexagonal network of oxygen atoms provided a natural ionic sieve for cesium. Cesium isotopes were held at these sites so strongly that the leaching became difficult. This was accomplished by using certain optimum concentrations of cesium or potassium in the solution to induce collapse of the layers during exchange reactions. Strontium was complexed with EDTA or any other suitable reagent and its participation in the exchange reactions was inhibited. This method may also have application in radioactive waste treatment. (P.C.S.)

**43131** STUDIES ON THE SEPARATION OF NIOBIUM FROM TANTALUM BY SOLVENT EXTRACTION USING TBP. Desai, H. B.; Pendharkar, M. S.; Das, M. Sankar (Atomic Energy Establishment, Trombay, India). pp 98-102 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Optimum conditions for the separation of Ta from Nb were established using radioactive tracers $^{182}$Ta and $^{95}$Nb and were applied to the analysis of columbite and samarskite by continuous column extractions using 40% TBP in kerosene. Results from 0.5$\underline{M}$ HF and 2$\underline{M}$ HCl media showed the extraction of Ta was nearly 100% in a single step. Tracer studied showed 1% cross-contamination of the two fractions, which could be removed by hydrofluorination of the final oxides. (P.C.S.)

**43132** SOME RECENT DEVELOPMENTS IN NEUTRON ACTIVATION ANALYSIS. Haldar, B. C. (Inst. of Science, Bombay). pp 189-93 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Examples are presented to review the recent trends in neutron activation, noting the availability of portable neutron sources and development of selective and radiochemical separation methods. (P.C.S.)

**43133** DETERMINATION OF RUBIDIUM AND CESIUM BY NEUTRON ACTIVATION. Reddy, G. R.; Das, M. Sankar (Atomic Energy Establishment, Trombay, India). pp 194-9 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A method was developed for the determination of Rb and Cs in standard silicate rocks by activation analysis after separation effected on an ion exchange column of ammonium phosphomolybdate. $^{86}$Rb activity was determined by $\beta^-$-decay and $\gamma$-spectrum; $^{134}$Cs was determined by measuring it under 0.796 Mev photopeak and by its $\gamma$-spectrum. Results compared favorably with USGS recommended values. (P.C.S.)

**43134** ISOTOPIC ANALYSIS OF LEAD BY NEUTRON ACTIVATION METHOD: ITS APPLICATION TO THE DETERMINATION OF THORIUM–LEAD AGES OF MINERALS. Athavale, V. T.; Parekh, P. P. (Atomic Energy Establishment, Trombay, India). pp 200-5 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The (n,n′) reaction on $^{204}$Pb and its application in the determination of absolute age of monazite from Chavara (Kerala) were studied. Methods for determination and results for thorium-total lead contents of monazite are presented, which are in reasonable agreement with previously reported values. The sensitivity of detection of $^{204}$Pb is discussed. (P.C.S.)

**43135** DETERMINATION OF ELEMENTAL CARBON IN LIQUID METAL REACTOR COOLANTS. Sundaresan, M. (Atomic Energy Establishment, Trombay, India). pp 206-10 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A simple and precise method capable of high sensitivity was developed based on the filtration of microgram quantities of elemental carbon from sodium, conversion of the carbon into $CO_2$ by dry combustion, and measurement of the $CO_2$ formed by a sensitive low-pressure method. Experiment indicated a standard deviation of 3.5 $\mu$g at the 10 $\mu$g level for recovery of carbon. (P.C.S.)

**43136** A NEW TECHNIQUE FOR THE DETERMINATION OF $^{14}$C IN BIOLOGICAL MATERIALS (URINE). Rudran, Kamala; Kamath, P. R. (Atomic Energy Establishment, Trombay, India). pp 297-302 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A rapid and efficient method for liberation of carbon dioxide from total carbon present in urine and absorption of carbon dioxide in a solvent that mixes homogeneously with dioxane scintillator solution was developed. A mixture of potassium nitrate and potassium bisulfate was found to be best for liberating the $CO_2$, with additions of potassium permanganate for oxidation of the volatile organic matter. Benzylamine was selected for the collection of $CO_2$ as it mixes well with scintillators POP and POPOP in dioxane solutions, is colorless, and does not quench nor increase background. Tracer experiments using labeled sodium carbonate and cytosine showed the overall efficiency to be about 95%. (P.C.S.)

**43137** DETERMINATION OF TRACE AMOUNTS OF COPPER USING THE QUANTITATIVE ISOTOPE DILUTION METHOD. Kudo, Kiyoshi (Nippon Telegraph and Telephone Public Corp., Tokyo). Radioisotopes (Tokyo), 15: 209-14(1966).

Trace amounts of copper were determined by the quantitative isotope dilution method and radioactivation analysis based on isotope dilution principles. A radioisotope of the known specific activity (radioactivity A, carrier content M) is added to an unknown amount $M_x$, and m, which is less than the total amount of the element, is separated. By measuring the radioactivity a of the separated fraction, $M_x$ is determined by the following equation: $M_x = m \cdot A/a - M$. In radioactivation analysis, the irradiated sample is divided into two parts, and M is added to one. An amount m is separated from each part, and then, a and a′ are measured. The unknown amount $M_x$ is calculated from $M_x =$

a'M/(a − a'). The experiment to determine the reaction ratio between copper and dithizone was carried out at various conditions and it was observed that the ratio was constant in the buffer solution of pH 5 containing 0.2 to 4.7 μg of copper. The reproducibility of the results was satisfactory. This method was applied to the determination of trace amounts of copper in materials and satisfactory results were obtained. (auth)

**43138** ACTIVATION ANALYSIS OF CANCER. Kato, Ryuhei (Ritumeikan Univ., Kyoto); Ono, Ryoichi; Kono, Toshihiko; Kishitani, Mikio; Ono, Masayoshi; Hayashi, Shuhei. Radioisotopes (Tokyo), 15: 221-3(1966).

An analysis of inorganic constituents of tumors by a neutron activation method using an atomic reactor is reported. A potassium peak in the $\gamma$ spectrum of activated cancer tissues taken from patients with advanced disease was found whereas no peak was found in other neoplasms or in the early stage of cancer. (auth)

**43139** SAMPLE COMBUSTION APPARATUS FOR LIQUID SCINTILLATION COUNTING. Morita, Itsuo; Murakami, Kazuo; Maekawa, Seihei (Kobe Industries Corp., Japan). Radioisotopes (Tokyo), 15: 254-9(1966). (In Japanese).

Preparation of samples for liquid scintillation counting by the combustion method was studied. Very different kinds of biological samples such as plant and animal tissues are used in studies using liquid scintillation counting. In this method, a $^{3}$H- or $^{14}$C-labeled sample is placed in an oxygen filled flask, and converted to THO or $^{14}CO_2$. Combustion conditions for several samples and collection methods for $H_2O$ and $CO_2$ were investigated. A circular flow collection method was applied to the collection, and collection efficiencies of more than 95 and 98% were obtained for $H_2O$ and $CO_2$, respectively. As a result of these experimental results, a sample combustion apparatus was constructed as a commercial product. Several examples of liquid scintillation counting measurements for samples prepared with this combustion apparatus are reported. (auth)

**43140** SALTS OF DYSPROSIUM WITH VARIOUS ORGANIC ACIDS. Spacu, P.; Antonescu, Elena (Centre of Inorganic Chemistry, Bucharest). Rev. Roum. Chim., 11: 697-700(June 1966).

Compounds of dysprosium with various organic acids, monobasic acids derived from benzoic acid(chloro- and bromomandelic), dibasic acids (mucic and saccharic), and violuric acid were studied. A method for the separation of dysprosium from other rare earths, under the form of chloro-mandelates in the presence of amino acids, was established. A gravimetric method for the determination of dysprosium was elaborated. (auth)

**43141** HALOGENOMANDELIC ACIDS, REAGENTS FOR THE SEPARATION AND DETERMINATION OF THE RARE EARTHS IN THE PRESENCE OF URANIUM(VI). Spacu, P.; Mavrodin, Maria (Institut de Chimie Inorganique, Bucharest). Rev. Roum. Chim., 11: 711-16 (June 1966). (In French).

A method is presented for the separation and quantitative determination of rare earths in the presence of uranium (VI), using chloromandelic and bromomandelic acids as reagents. The proposed method is based on the property of the halogenomandelic acids to precipitate the rare earths quantitatively and to form, under the same conditions, a soluble complex with uranium (VI). (tr-auth)

**43142** ANALYSIS OF COPPER SULFATE SOLUTIONS BY THE $\beta$ RADIATION REFLECTION METHOD. Marcu, Gheorghe; Ciora, Letitia. Stud. Univ. Babes-Bolyai, Ser. Chem., 11: No. 1, 125-8(1966). (In Rumanian).

A method for the analysis of pure copper sulfate solutions between the concentration limits of 1.5 to 12.43% and in the presence of sulfuric acid (200 g/l) by the reflection of $\beta$ radiations was developed. The method is fast (1 to 2 min) and the precision is satisfactory at ±0.1%. The method is easily automated and can be used for the continuous reporting of the concentration of Cu sulfate solutions in various technological processes because of the coupling of the installation with an automatic recording integrator. (tr-auth)

**43143** PHOTOMETRIC CERIUM DETERMINATION IN CAST IRON AND ALLOYED STEEL WITH THE HELP OF TETRON. Jordanov, N.; Antonova, N.; Daiev, C. (Institute fuer Allgemeine und Anorganische Chemie, Academie der Wissenschaften, Bulgaria. Univ., Sofia). Talanta, 13: 1459-62(Oct. 1966). (In German).

Traces of cerium in cast iron and high-alloy steels were determined by oxidizing tetron (N,N'-tetra-methyl-o-tolidine) with cerium(IV) to yield an intensely orange-yellow product with $\epsilon$ = 25,300. Cerium can be determined in the presence of a 200-fold excess of Mn, Ti, Cr, Ni, Co, W, Mo, V, etc. The cerium contents of some steels were determined and the results statistically evaluated. (auth)

**43144** TITRIMETRIC DETERMINATION OF VANADIUM(IV) WITH CERIUM(IV) SULPHATE AT ROOM TEMPERATURE USING FERROIN AS INDICATOR. Sriramam, K.; Rao, G. Gopala (Andhra Univ., Waltair, India). Talanta, 13: 1468-9(Oct. 1966).

A procedure was developed for the visual titrimetric determination of vanadium(IV) with cerium(IV) sulfate, using ferroin as redox indicator. The method was extended to the determination of iron(II) and vanadium(IV) in mixtures. (auth)

**43145** NEW GRAVIMETRIC METHOD FOR COBALT. Chatterjee, G. P.; Ray, H. N.; Biswas, Kalyan (Durgapur Steel Plant, West Bengal, India). Talanta, 13: 1470-2 (Oct. 1966).

A gravimetric method for the determination of cobalt was developed, based on precipitation from acidic solution with a reagent prepared by heating $\alpha$-nitroso-$\beta$-naphthol in a mixture of glacial acetic acid, hydrogen peroxide, and syrupy phosphoric acid. The cobalt was weighed, after ignition of the precipitate, as $Co_3O_4$. Iron(III), copper, chromium(III), vanadium(V), tungsten(VI), aluminum, molybdenum, nickel, titanium, zirconium, uranium(VI), and cerium do not interfere. (auth)

**43146** MASS-SPECTROMETRIC METHOD OF ANALYSIS OF THE ISOTOPE CONTENT OF OXYGEN IN PHOSPHATES AND WATER. Il'in, L. A.; Maksimov, N. A.; Panteleeva, N. S. (State Univ., Leningrad). Vop. Med. Khim., 12: 211-16(Mar.-Apr. 1966). (In Russian).

A modified micromethod is described for preparation of samples of inorganic phosphate for mass-spectrometric analysis of the isotope composition of oxygen. The method enables utilization of about 3 to 5 mg of monobasic potassium phosphate for analysis. The water liberated after pyrolysis of this salt is equilibrated with $CO_2$ in conditions of high-voltage discharge. (auth)

**43147** EXPRESS METHOD FOR SEPARATING IONIUM ($^{230}$Th) FROM SULFURIC ACID URANIUM SOLUTIONS. Karalova, Z. K.; Shibaeva, N. P.; Pyzhova, Z. I. Zh. Anal. Khim., 21: 950-3(1966). (In Russian).

Data on the absorption of $^{230}$Th, U, Pa, Po, Zr, Fe, Mn, and rare earths on sorbents in relation to the concentration of sulfuric acid are given, and a rapid method was developed for $^{230}$Th determination in sulfuric acid uranium solutions. $^{230}$Th is separated from a number of other elements in 0.05 to 1$\underline{N}$ $H_2SO_4$ on an anion exchange resin, then the filtrate is passed through a cation exchange resin. The elements sorbed together with $^{230}$Th are removed by 2$\underline{N}$ $HNO_3$, then $^{230}$Th is eluted with a saturated ammonium carbonate solution and determined radiometrically. The extraction percent is about 80% of $^{230}$Th. One determination takes 2 hr. (auth)

**43148** SEPARATION OF PROTACTINIUM FROM OTHER ELEMENTS BY SORPTION ON ACTIVATED CHARCOAL SATURATED WITH PHENYLARSONIC ACID. Palshin, E. S.; Myasoedov, B. F.; Novikov, Yu. P. (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Anal. Khim., 21: 954-60(1966). (In Russian).

Sorption of protactinium and other elements from sulfuric acid solutions by activated charcoals saturated with phenylarsonic acid was studied. Conditions were established for the effective separation of protactinium from iron, uranium, aluminum, magnesium, manganese, rare earths, and other elements. The method can be used for protactinium separation from these elements in the analysis of ores containing protactinium. When protactinium is concentrated from uranium ores, the weight of waste elements can be decreased more than 100 times. The yield of protactinium is practically quantitative. (auth)

**43149** CERTAIN QUESTIONS OF FINDING OPTIMUM CONDITIONS IN RADIOACTIVATION ANALYSIS OF BINARY SYSTEMS. Tsirlin, Yu. A.; Gelfman, A. Yu.; Mokhir, E. P. (All-Union Scientific Research Inst. of Monocrystals, Scintillation Materials and Specially Pure Chemicals, Kharkov). Zh. Anal. Khim., 21: 1012-15(1966). (In Russian).

Optimum times of activation and cooling of the sample in radioactivation analysis were calculated. Necessary recommendations are given concerning the choice of optimum conditions and carrying out radioactivation analysis depending on the half lives of the determined and interfering isotopes. (auth)

**43150** FLUORIMETRIC DETERMINATION OF YTTRIUM IN A MIXTURE OF RARE EARTH ELEMENTS AFTER THEIR SEPARATION BY PAPER CHROMATOGRAPHY. Kirillov, A. I.; Lauer, R. R.; Poluektov, N. S. (Inst. of General and Inorganic Chemistry, Odessa). Zh. Anal. Khim., 21: 1018-20(1966). (In Russian).

A rapid fluorimetric method was developed for the semiquantitative determination of yttrium in chromatographic zones after separation of rare earths by means of partition paper chromatography. The yttrium content is evaluated by the direct fluorimetry of the part of the chromatogram where the yttrium zone is located after the chromatogram is treated by a phenyl salicylate solution. The method was checked on neodymium nitrate solutions (25 mg/ml) containing various amounts of yttrium nitrate. The fluorescence intensity is directly proportional to the yttrium content in the zone if its total amount is not more than 4 to 4.5 μg. The lower limit of sensitivity is 0.5 μg of yttrium. (auth)

**43151** DETERMINATION OF URANIUM BY MEASURING THE WIDTH OF THE LUMINESCENCE ZONE ON A CHROMATOGRAM. Gorbacheva, N. A.; Konstantinova-Schlesinger, M. A. Zh. Prikl. Spektrosk., Akad. Nauk BSSR, 3: 172-4(Aug. 1965). (In Russian).

The luminescence of the uranyl ion in an adsorbed state is taken as an indicator of the width of the zone on the chromatogram and the interval of concentrations is determined in which a direct proportionality is observed between the concentration and the width of the zone of uranyl adsorption on the chromatogram. The possibility of using this method of analysis when other ions are present in the solution is shown. (auth)

**43152** EFFECT OF CHLORINE ON SPECTRA OF RARE EARTH ELEMENTS IN A FLAME. Ovchar, L. A.; Mishchenko, S. A.; Poluektov, N. S. Zh. Prikl. Spektrosk., Akad. Nauk BSSR, 3: 306-10(Oct. 1965). (In Russian).

An investigation was made of the effect of vapors of $CHCl_3$ on spectra of rare earth metals in a flame of a mixture of acetylene and air. It was found that radiation of both oxide molecules and atoms (Eu, Yb) is thus weakened. The influence of additions of chlorine on the radiation of rare earth elements in a flame is explained as the result of the formation of molecules of weakly dissociating chlorides, leading to the disappearance from the flame of radiating molecules MeO or of Me atoms. This is confirmed by the appearance of new bands due to molecules of europium and lutetium chloride radiation. The study of the relationship between the intensity of radiation of atoms or oxide molecules and the partial pressure of chlorine in a flame leads to the conclusion that molecules of the $MeCl_2$ type are formed in the flame. (auth)

**43153** THE BEHAVIOR OF IRRADIATION PRODUCTS OF U IN HETEROGENEOUS REACTIONS BETWEEN NEUTRON IRRADIATED U COMPOUNDS AND COMPLEXING AGENTS. Ammentorp-Schmidt, F. Munich, Technical Univ., 1965. 76p. $2.00 Gmelin, AED-Diss. 65-361. Thesis.

Separation of radiation products from uranium dioxide and uranium hydride with phthalocyanine as complexing agent was studied. Separation yields for Np, Pu, and various fission products are given. Methods for identification and quantitative analysis of irradiation products by $\alpha$ and $\gamma$ spectroscopy are described. (Gmelin Inst.)

**43154** DETERMINATION OF TRACE ELEMENTS IN TUNGSTEN AND MOLYBDENUM BY ATOMIC ABSORPTION SPECTROPHOTOMETRY. Muntz, James H.; Roush, Larry L. 13p. (CONF-660611-7). ORAU. Gmelin, AED-CONF-66-172-9.

From Society of Applied Spectroscopy Meeting, Chicago.

A method is described for the determination of ten trace elements in W and eight in Mo. The method uses an atomic absorption spectrophotometer with a direct readout. The samples were prepared in acid medium, and for most purposes, simple acid standards in 10% HF gave satisfactory results. If enough sample is available and the time required is not critical, the method of additions can be used. Sensitivity is better for some elements and comparable for others when compared with optical emission techniques. Complete instrumental conditions for the determination are listed in tabular form. (B.L.M.)

**43155** DETERMINATION OF OXYGEN AND SODIUM IN ALUMINUM AND ITS ALLOYS BY RADIOACTIVATION AND $\gamma$-RAY SPECTROSCOPY. Deutschman, J. E. (Aluminum Co. of Canada, Ltd., Arvida, Quebec). 8p. (CONF-651066-1). ORAU. Gmelin, AED-CONF-65-359-1.

From 12th Ottawa Symposium on Applied Spectroscopy, Ottawa.

Sodium is determined in Al and/or Al alloys by a radiochemical process in which actual samples of the Al or Al alloy, known amounts of $NaNO_3$, and samples of zone-refined Na-free Al are all sealed in quartz capsules, loaded into Al containers and irradiated with mainly slow neutrons from a reactor. After irradiation for 12 hours, the gamma count of the pure Al is subtracted from that of the samples to obtain the net count due to natural Na in the samples. The Na is then separated from the samples after dissolution by a double precipitation of the sodium zinc uranyl acetate, and the gamma activity of the $^{24}Na$ measured with a multichannel gamma spectrometer. Oxygen is determined by converting the $O_2$ to $^{16}N_2$ by (n,p) reaction and immediately counting the gamma radiation from the $^{16}N_2$. To eliminate serious interference of two coincident peaks due to $^{24}Na$, the gamma activity of the sample is measured again after the $^{16}N_2$ is allowed to decay with its short half life of about 7 sec. The remaining activity due to the $^{24}Na$ is subtracted from the original activity to yield the $^{16}N_2$ (hence the $O_2$ content) by difference. (B.L.M.)

**43156** NEW TYPE OF ARGON-IONIZATION, HELIUM-ELECTRON CAPTURE DETECTOR FOR GAS CHROMATOGRAPHY. Sporek, K. F. (Owens-Illinois Technical Center, Toledo). 3p. (CONF-650809-3). ORAU. Gmelin, AED-CONF-65-229-2.

From Society for Applied Spectroscopy, 4th National Meeting, Denver.

An argon-ionization He-electron capture detector with a small source of $^{147}Pm$ is described for use as a detector for gas chromatography. The indicator gives a high background current with only He flowing through it; but when small quantities (as little as 1 μl) of any other vapor or gas are added to the He stream, the original high current is reduced proportionately to the concentration of the substance. The voltage produced at the signal electrode is sufficiently high to use the detector without an amplifier. The detector is sensitive to all organic and inorganic substances, permanent gases, and noble gases. (B.L.M.)

**43157** PROCESS GAS CHROMATOGRAPH FOR REACTOR BLANKETING GAS. Richardson, Robert D. (Thermco Instrument Corp., LaPorte, Ind.). 10p. (CONF-650311-7). ORAU.

From Conference on Analytical Chemistry and Applied Spectroscopy, Pittsburgh.

A continuously operating gas chromatograph was developed to measure the impurities in the blanketing gas over the reacting fluid in a nuclear reactor, particularly the helium blanket over a heavy water bath in a neutron-producing reactor. The operating of the chromatograph was confined to using a molecular sieve column and a thermal conductivity cell for measurement. This would show, on a continuous detection basis, 1 or 2 ppm of such impurities as $H_2$, $CH_4$, $CO_2$, $O_2$, and $D_2$. Under normal operating conditions, the only impurity that was not in the original He was $D_2$. (B.L.M.)

**43158** CONTRIBUTION OF THE ALPHA-GAMMA AND BETA-GAMMA COINCIDENCES USING A SIMPLE DEVICE TO THE ANALYSIS OF Pu–Am, Np–Pu, Ru Rh Zr Nb MIXTURES. **Pottier, Raymond; Berger, Rene (Commissariat a l'Energie Atomique, Fontenay-aux-Roses, France). 31p. (CONF-651004–12).**

**From 9th Conference on Analytical Chemistry in Nuclear Technology, Gatlinburg, Tenn.**

A simple device using the contribution of the $\alpha$-$\gamma$ and $\beta$-$\gamma$ coincidences was applied to the determination of $^{241}$Am in the presence of $^{238}$Pu, $^{237}$Np in the presence of $^{239}$Pu, and $^{106}$Ru$-^{106}$Rh in the presence of $^{95}$Zr$-^{95}$Nb for two ranges of Rh activity. Multidimensional analyzers nor computers are not necessary to the determination. A block diagram of the device and a detailed outline of the procedure are presented. Preparation of the sources from both aqueous and organic materials is described. (B.L.M.)

**43159** NEUTRON ACTIVATION ANALYSIS UTILIZING THE SIMPLEX METHOD OF LINEAR PROGRAMMING. **Kerrigan, Felix J. (Veterans Administration Hospital, Omaha). 13p. (CONF-660611–6). ORAU. Gmelin, AED-CONF-66-172-4.**

**From Fifth National Meeting, Society for Applied Spectroscopy, Chicago.**

The Simplex method of linear programming was applied to the gamma decay spectrum arising from the neutron activation of mixtures of inorganic chemicals containing the same elements as those used in individual standards. The resolved spectrum from the computer was a perfect fit for the sample spectrum and the process correctly identified the elements that were present. The results were not precise for small contributors, but the accuracy increased sharply for the elements with greater contribution. (B.L.M.)

**43160** INDUSTRIAL APPLICATIONS OF NEUTRON ACTIVATION. **Gray, A. L.; Metcalf, A. (Plessey-UK Ltd., Hants, Eng.). 10p. (CONF-650405–22). ORAU. Gmelin, AED-CONF-65-040-33.**

**From International Conference on Modern Trends in Activation Analysis, College Station, Tex.**

An automatic self-contained neutron activation apparatus called the Analox is proposed for the determination of oxygen in steel samples. Except that the equipment must stand on the ground floor since no shielding is provided beneath the generator, the apparatus is completely self-shielded. The upper practical limit of sample size accommodated by the apparatus is a disc 1½ in. in diameter and ½ in. thick, which corresponds to about 110 g of steel. The sensitivity of the apparatus is better than 30 counts/mg of $O_2$. Costs of analysis on various samples are presented. Currently, experiments are underway to adapt the apparatus to the determination of ash content of coal traveling on a conveyor belt. (B.L.M.)

**43161** PRIMARY X-RAY ANALYZER. [PART] II. **Kimoto, S. (Japan Electron Optics Lab. Co., Ltd., Tokyo); Sato, M.; Kamada, H.; Ui, T. 6p. (CONF-650810–5). ORAU. Gmelin, AED-CONF-65-212-11.**

**From Annual Conference on Applications of X-Ray Analysis, Denver.**

Apparatus and method are proposed for the determination of the lighter elements, $O_2$, $N_2$, C, and B in a solid specimen, such as steel, by electron excitation of characteristic x rays. In order to obtain a good peak-to-background ratio, the apparatus includes a magnetic deflector located at the window of the spectrometer to avoid electrons scattered from the specimen. In order for the method to be practical, it was found to be necessary to provide good heat conductivity and a large heat capacity or to coat the specimen with some electroconductive material by vacuum evaporation. (B.L.M.)

**43162** DETERMINATION OF IRON IN TANTALUM AND COLUMBIUM BY ATOMIC ABSORPTION SPECTROPHOTOMETRY. **Coyle, Francis T.; Goulden, Robert J.; Gannon, William C.; Foster, John E. (Kawecki Chemical Co., Boyertown, Pa.). 9p. (CONF-660214–2). ORAU. Gmelin, AED-CONF-66-039-2.**

**From American Chemical Society, 1st Middle Atlantic Regional Meeting, Philadelphia.**

An atomic absorption spectrophotometric method for the determination of Fe in Nb and Ta powders, foils, ingots, or fabricated materials consists of dissolving the metal in HF and a small amount of $HNO_3$, diluting to volume, atomizing through a lacquer-coated nozzle on a spectrophotometer with recorder readout, and calculating the concentration of Fe from the recorded absorbance. Coating the nozzle with lacquer was necessary to prevent erratic results due to the dissolution of the nozzle. For a 1 g sample of either Nb or Ta, amounts of Fe from 10 to 100 $\mu$g are shown on the calibration curve as giving a satisfactory absorbance reading. Complete experimental details, instrumental conditions, comparison of results with spectrographic and wet chemical analyses and precision data are all presented. (B.L.M.)

**43163** RADIOACTIVITY ANALYSIS OF A MEDIUM UTILIZING A PULSED NEUTRON SOURCE. **Armistead, Fontaine C. (to Texaco Development Corp.). U. S. Patent 3,256,438. June 14, 1966. Filed Nov. 14, 1955.**

An apparatus for analyzing a medium for various parameters includes a pulsed neutron source. The source is adapted to produce neutron burst of a predetermined duration at a predetermined repetition rate. The radiation emanating from the medium is detected by a Geiger-Mueller type detector having a predetermined characteristic dead time and being responsive to the production of bursts of neutrons by the source. The detector is caused to discharge at the time of a burst from the source to render the detector insensitive for the period of its dead time and then again become sensitive to neutrons from the source. A signal display device is coupled to the detector for providing information concerning detected radioactivity and include means for correlating the rate-of-occurrence of detected radioactivity throughout a predetermined time interval. The apparatus is suitable to the following determinations: characterizing mineral deposits in the earth's formations within a borehole, determining salinity of a brine solution while the solution under test is within a closed container or flowing through a system, determining the density or specific gravity of an earth's formations in situ, determining the earth's porosity in situ, and analyzing a medium in the presence of certain foreign matter that would interfere with conventional radioactivity analysis techniques. (B.L.M.)

## Inorganic and Physical Chemistry

*Refer also to abstracts 43076, 43818, 43841, 43850, 43854, 43931, 43934, 43935, 43954, 43981, 44032, 45008, and 45010.*

**43164** (ANL–7142) LABORATORY INVESTIGATIONS IN SUPPORT OF FLUID-BED FLUORIDE VOLATILITY PROCESSES. PART X. A LITERATURE SURVEY ON THE PROPERTIES OF TELLURIUM, ITS OXYGEN AND FLUORINE COMPOUNDS. **Vissers, D. R.; Steindler, M. J. (Argonne National Lab., Ill.). Feb. 1966. Contract W-31-109-eng-38. 81p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.**

The results of a literature survey of the properties of tellurium, its oxides, fluorides, and oxyfluorides have been assembled. The pertinent data for the physical and chemical properties as well as the behavior of tellurium in processing of nuclear fuels by fluoride volatility methods are included. An appendix containing tabulated vapor pressures and abstracts (149) of all pertinent references is furnished. 111 references. (auth)

**43165** (BM-RI-6836) DENSITY AND MOLAR VOLUMES OF BINARY FLUORIDE MIXTURES. Porter, Bernard; Meaker, R. E. (Bureau of Mines, Reno, Nev. Reno Metallurgy Research Center). Mar. 1966. 14p. Bureau of Mines Free.

The densities of LiF, NaF, and KF, of binary mixtures of these alkali fluorides, and of binary mixtures of $UF_4$, $ThF_4$, $YF_3$, $LaF_3$, and $CeF_3$ with each of the alkali fluorides were measured as functions of the melt composition and temperature. Molar volumes at 1,000°C were calculated for all the mixtures. Binary systems containing LiF exhibited molar volume ideality. Binary fluoride systems containing either NaF or KF as the alkali fluoride exhibit positive deviations from molar volume additivity. However, molar volumes in the NaF–KF system are ideal. (auth)

**43166** (BMI-1781) CHEMICAL-EQUILIBRIUM STUDIES OF ORGANIC-IODIDE FORMATION UNDER NUCLEAR-REACTOR-ACCIDENT CONDITIONS. Barnes, Russell H.; Kircher, John F.; Townley, Charles W. (Battelle Memorial Inst., Columbus, Ohio). Aug. 15, 1966. Contract W-7405-eng-92. 34p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The presence of $CH_3I$ in nuclear-reactor environments poses a potential hazard because of the difficulties involved in removing this compound from gases using conventional trapping techniques. To gain insight into the chemical processes leading to $CH_3I$ formation, a study was performed of calculated equilibrium concentrations of $CH_3I$ and other important species for a range of conditions typical of reactor-accident systems. The results of this study indicated that chemical systems containing simple compounds such as $CO_2$, $H_2O$, $CH_4$, and iodine would be expected to generate $CH_3I$. The calculated equilibrium concentrations of $CH_3I$ were found to be several orders of magnitude lower than those observed in comparable experimental systems, indicating that chemical-kinetic factors are important. A preliminary study of the practicality of solving the kinetic problem was made. (auth)

**43167** (BMwF-FBK-66-11) UNTERSUCHUNGEN UEBER ANLAGERUNGSVORGAENGE RADIOAKTIVER AEROSOLE. (Investigations into Attachment Properties of Radioactive Aerosols). Mohnen, V. (Munich Univ. (West Germany). Erstes Physikalisches Institut). May 1966. 58p. Dep. mn. DM 11,00.

The attachment of small ions and radioactive decay products (from Radon or Thoron) to aerosols was studied, starting with the exact solution of the diffusion equation. For the first time, all parameters in this equation are discussed, and all possibilities to simplify the resulting equation are theoretically examined for deviations from the exact value. Also a strong differentiation was made between the attachment of neutral and electrically loaded, radioactive decay products. The time for ion capture and neutral decay product capture to a given aerosol mixture was calculated. A method to determine the total number of particles and their size spectrum (using a cylindrical condensor as particle discriminator) was theoretically established. (auth)

**43168** (DP-1065) ELECTROLYTIC PREPARATION OF URANOUS NITRATE. Nichols, G. Starr (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). Aug. 1966. Contract AT(07-2)-1. 16p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Laboratory and semiworks electrochemical converters for producing uranous nitrate from uranyl nitrate were designed and operated. The laboratory unit, with a porous separator between cathode and anode, gave good performance. A suitable separator was not available for the semiworks unit, so a simple recirculation design was used to produce sufficient uranous nitrate for testing as a plutonium reductant in the plant. The performance of this design was poor because of oxidation at the anode of both uranous ion and the hydrazine used as stabilizer. (auth)

**43169** (IPP-1/49) IONISIERUNGSENERGIEN VON ATOMEN UND IONEN DER ELEMENTE H BIS Ni (Z = 28). (Ionization Potentials of Atoms and Ions from H to Ni (Z = 28)). Lotz, Wolfgang (Institut fuer Plasma-physik, G.m.b.H., Garching (West Germany)). July 1966. 29p. Dep. mn.

A complete set of ionization potentials of all ionization stages is given for the elements hydrogen through nickel (Z = 28). The ionization potentials were calculated along isoelectronic sequences with full regard to experimental values. Along experimentally well established sequences the difference to the next higher species was calculated by extrapolation of the differences of the differences (second difference or second derivative) and the third difference (derivative). Experimentally not so well established sequences were calculated by extrapolation of the difference to the same ionization stage of one of the better known sequences. Similarities in the periodic table were taken into account. (auth)

**43170** (IS-T-107) SEPARATION OF NIOBIUM AND TANTALUM BY REACTION OF THE METAL PENTACHLORIDES WITH CALCIUM OXIDE AND CALCIUM FLUORIDE. Conway, John Edward Jr. (Ames Lab., Iowa State Univ. of Science and Tech.). Aug. 1966. Contract W-7405-eng-82. 63p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Thesis.

The reactions of niobium and tantalum pentachlorides with calcium fluoride, calcium fluoride coated with calcium oxide, and calcium oxide were studied. Experimental data were obtained in the extent of reaction and reaction products in the temperature range of 350 to 600°C with tantalum pentachloride concentrations of 0, 20, 50, and 100 weight percent (based on $TaCl_5$ and $NbCl_5$ in feed). The results indicate that niobium can be separated from tantalum by reaction of the mixed pentachlorides with calcium oxide and calcium fluoride in sequence or by reaction with calcium fluoride coated with calcium oxide. In each case essentially all of the tantalum was retained on the reaction bed as a nonvolatile product while most of the niobium (up to 92%) was recovered as a very pure volatile product (>99.9% niobium by weight). It was found that the pentachlorides could not be efficiently separated by reaction with pure calcium fluoride or by reaction with pure calcium oxide. In the case of calcium fluoride both the pentachlorides reacted at nearly equal rates to form nonvolatile compounds. A partial separation was achieved using calcium oxide but the yield-purity relationship of the product was such that a satisfactory yield of a reasonably pure niobium product (>99.0% by weight) could not be obtained. (auth)

**43171** (LA-DC-7394(Rev.)) NUCLEAR MAGNETIC RELAXATION MEASUREMENTS OF $^{17}O$ IN ENRICHED $H_2{}^{17}O$ AND $D_2{}^{17}O$. Denison, A. B. (Wyoming Univ., Laramie); Rabideau, S. W. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1961]. Contract W-7405-eng-36. 15p. (CONF-660924-2). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Magnetic Resonance and Relaxation, 14th Colloque AMPERE, Ljubljana, Yugoslavia.

Relaxation times $T_1$ and $T_2$ were obtained for oxygen-17 as a function of temperature in 22% $H_2{}^{17}O$ and in 22% $D_2{}^{17}O$. This enrichment resulted in signal strengths which permitted the nuclear induction tail and the spin echo to be observed for the first time. In addition, linewidth measurements of the oxygen-17 resonance were obtained with the use of the sideband and the derivative of absorption techniques. Values of $T_1$ were obtained by the pulse method and also by a saturation procedure with the nuclear magnetic resonance absorption spectrometer. These data are consistent with the nuclear quadrupole relaxation mechanism in a liquid, although for $D_2O$ there appears to be in addition a small temperature-independent contribution to the relaxation. The value of the effective oxygen-17 quadrupole coupling constant was found to be temperature independent between 5 and 95°C and has the value 6.2 ± 0.4 MHz for $D_2{}^{17}O$ and 7.7 ± 0.6 MHz for $H_2{}^{17}O$. (auth)

**43172** (NAA-SR-Memo-11966) LEAST SQUARES DETERMINATION OF ISOTHERMAL RATE CONSTANTS FOR THE OXIDATION OF METALS. Young, W. A. (Atomics International, Canoga Park, Calif.). June 14, 1966. Contract AT(11-1)-Gen-8. 104p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

A least squares computer program is described which permits the solution of the rate expression, $(\Delta m + c)_n = Kt$, for all combinations of the three parameters, C, n, and K where $\Delta m$ is weight change per unit area, C is a corrective constant, K is the rate constant, and t is time. The program is written in FORTRAN IV for use with IBM 7090/7094 and Systems 360 equipment, and provides for graphic display of data points and the least squares curve by means of SC-4020 automatic display equipment. (auth)

**43173** (NAA-SR-Memo-12006) PHYSICAL PROPERTIES OF STEAM AND WATER ABOVE 1000 psia. Logan, D. (Atomics International, Canoga Park, Calif.). June 6, 1966. Contract AT(11-1)-Gen-8. 15p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Lack of readily available physical property data for water and steam at pressures and temperatures needed for the once through steam generator necessitated a literature survey. The literature survey clearly brought forth the fact that most of the physical properties at least for steam are not clearly established. Different experimental investigations resulted in large disagreements of more than a factor of two. Consequently, the most reliable data were chosen to be presented. The physical properties included are the specific heat, viscosity, and thermal conductivity of steam and water at pressures above 1000 psia. Also given are the density and Prandtl Moduli for water at elevated pressures. (P.C.H.)

**43174** (NASA-CR-608) CONTAINMENT OF LIQUID ZIRCONIUM AND NIOBIUM CARBIDES ON GRAPHITE BETWEEN 3500 DEG AND 4700 DEG K. Cahill, J. A.; Grosse, A. V. (Temple Univ., Philadelphia, Pa.). Sept. 1966. 41p. CFSTI $2.00 cy, $0.50 mn.

Three niobium and two zirconium carbide liquid pipes approximately 4.5 cm long × 3 cm ID × 0.5 cm wall were contained in rotating graphite crucibles at temperatures between 3800 and 4700°K for periods between 2 and 10 minutes. The heat source used was a rotating double arc furnace operated in a helium atmosphere. The increase in carbon content of the carbide pipes under the conditions of these tests and the recession (i.e., decrease in wall thickness of the graphite crucibles supporting the carbides) caused by the sublimation and solubility of the graphite were measured. The results indicate the order of magnitude that can be expected for this recession if pure graphite is used as a crucible or pipe material to contain the carbides is about 0.1 mm/min or 6.0 mm/hr. (auth)

**43175** (NP-16301) THE SPECTRUM OF ERBIUM(IV). Carter, William J. (Johns Hopkins Univ., Baltimore, Md. Dept. of Physics). June 1966. 107p.
Thesis.

The free-ion spectrum of triply ionized erbium has been obtained and 70 levels of the four lowest configurations were classified. In particular, 27 of the possible 41 levels of the $4f^{11}$ configuration were established; the remaining levels belong to higher configurations of the $^5I_8$, $^5I_7$, and $^5I_6$ cores. In addition, 95 levels of the $4f^{10}5d$ configuration were discovered but not assigned to any definite core. A comparison was made between the free-ion $4f^{11}$ levels and the corresponding crystal levels for a number of host crystals, showing that the crystalline environment affects the free-ion energy levels by no more than one percent. (auth)

**43176** (NP-16302) ISING CHAIN STATISTICS AND MAGNETIC PHASES IN RARE EARTH TRICHLORIDES. Marsh, James S. (Johns Hopkins Univ., Baltimore, Md.). 1966. 122p.
Thesis.

The magnetic phases and susceptibilities of certain rare earth trichlorides were investigated; a molecular field theory in which the Ising chain is the fundamental magnetic unit was used. When the near neighbor coupling constant, $J_1$, is antiferromagnetic there appears to be possible an array of unusual magnetic phenomena; these include no phase transition, a first order phase transition, unusual domain structure, and unusual hysteresis effects. These results were applied to the susceptibility data of others. Methods for transcending the molecular field treatment were developed via thermodynamic perturbation theory applied to the Ising chain. It is shown that the statistical sums arising in the perturbation theory may be evaluated by inspection in terms of the n-spin correlation functions of the Ising chain, which are derived in general. The contributions to the free energy from the parts of the nn and nnn interactions not contained in the Ising part of the Hamiltonian were calculated to second order in the coupling constants. The contribution from the Ising part of the nnn interaction was developed via a diagrammatic technique by which was exhibited an analogue to the linked cluster expansions. A method for reducing the Ising problem in n dimensions to one in n-1 dimensions was indicated. (auth)

**43177** (NP-16303) MAGNETIC STUDIES ON ERBIUM AND TERBIUM IN GADOLINIUM TRICHLORIDE. Randazzo, Donald J. (Johns Hopkins Univ., Baltimore, Md.). 1966. 134p.
Thesis.

The spectra of Er and Tb in $GdCl_3$ were investigated. Specifically, extensive Zeeman series were obtained for the D, E, and F groups of Er with fields applied both parallel and perpendicular to the $GdCl_3$ crystal axis. An extensive Zeeman series was also obtained for the $^5D_4$ group for Tb for fields applied parallel to the crystal axis. It was found that the Zeeman splittings of the rare earth impurity depend on the magnetic permeability of the $GdCl_3$ host. This is significantly different from unity and it must be considered in order to get a correct set of Zeeman factors for the rare earth states. A theoretical expression was derived for the magnetization of $GdCl_3$, and with this, the permeability of the crystal was calculated for the conditions of temperature and field used in the experiments. The calculated permeabilities are shown to yield splitting factors for the rare earth states which are consistent with Zeeman calculations performed with the crystal eigenstates and also with a second set of experimental values for these factors which were determined independent of any permeability considerations. Below the Curie temperature of the $GdCl_3$ lattice, a spontaneous splitting of the magnetically degenerate rare earth levels was observed with no external field applied. (P.C.H.)

**43178** (NRL-6394) INTENSITY MEASUREMENTS OF SOME FUNDAMENTAL ABSORPTION BANDS OF $H_2O$, $D_2O$, AND $CS_2$. (Naval Research Lab., Washington, D. C.). May 27, 1966. 10p.

Techniques for fabricating and calibrating liquid absorption cells having path lengths of about 1μ were developed. The thin spacers required for such cells were formed by the vacuum deposition of aluminum directly onto the cell windows. The path lengths of the assembled cells were determined by the well known interference fringe method. However, in order to produce discernible fringes in the visible and near-ultraviolet spectral regions, it was necessary to polish the internal surfaces of the cell windows to a high degree of flatness. Using such cells, several very intense bands of $H_2O$ (3410 and 1645 $cm^{-1}$), $D_2O$ (2510 $cm^{-1}$), and $CS_2$ (1510 $cm^{-1}$) were measured. The absorptivity values obtained for $H_2O$ and $D_2O$ appear to be significantly higher than those reported previously, while the integrated intensity of the $\nu_3$ band of $CS_2$ is somewhat less than that calculated from dispersion and reflectance data. Distortion of the cell by the liquid sample and photometric accuracy of the spectrometer are briefly discussed as possible sources of systematic error. (auth)

**43179** (NYO-2082-6) HIGH TEMPERATURE INORGANIC CHEMISTRY. Eighth Annual Progress Report, July 1, 1965 to July 31, 1966. Grosse, A. V.; Cahill, J. A. (Temple Univ., Philadelphia, Pa. Research Inst.). Aug. 15, 1966. Contract AT(30-1)-2082. 39p. (RITU-1966-18). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Results are reported for studies on: electric conductivity of liquid tin to 2200°K, liquid bismuth to 1600°K, and liquid lead to 1800°K; use of heat pipe to measure thermal conductivity of solids and liquids by using it with centrifugally rotating liquid pipes; liquid aluminum oxide window; interaction of tungsten with liquid tin, bismuth, and lead; behavior of liquid tungsten carbide with the liquid solution of carbon in zirconium carbide; and centrifugal plasma jet apparatus. (P.C.H.)

**43180** (ORNL-3997) X-RAY DIFFRACTION DATA ON LIQUID WATER IN THE TEMPERATURE RANGE 4 TO 200 DEG C. Narten, A. H.; Danford, M. D.; Levy, H. A. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 154p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

The scattering of x-rays from the free surface of liquid water in equilibrium with water vapor was measured and analyzed at 4, 25, 50, 75, 100, 150, and 200°C. Deuterium oxide at 4°C was also studied. The diffractometer used was specially designed for the study of liquid samples. At each scattering angle, up to 600,000 counts were recorded to assure meaningful counting statistics, and data collection was extended to values of 16 in $s = (4\,\pi/\lambda)\sin\theta$. Both the raw data and the intensity and radial distribution functions derived from them are presented in tabulated form. The experimental radial distribution functions are in agreement with most of the previously published work on water, showing, however, much higher resolution. They show deviations from a uniform distribution of distances out to 8 Å at room temperature, and significant but gradual changes occur with increasing temperature. (auth)

**43181** (ORNL-P-2439) EXAMINATION OF PRASEODYMIUM AND EUROPIUM HYDROXIDE SOLS BY ELECTRON MICROSCOPY AND ELECTRON DIFFRACTION. Willmarth, T. E. (Oak Ridge National Lab., Tenn.). [nd]. Contract W-7405-eng-26. 14p. (CONF-660813-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From American Meeting of the Royal Microscopical Society, Chicago, Ill.

Electron microscope studies showed that striking metamorphic alterations take place in the hydroxide sols of the lanthanide elements as aging proceeds, with considerable difference, time-wise, from element to element as to when the change from a nearly amorphous state to the crystalline state takes place, and when maximum growth is achieved. Depending on the element involved, crystal size at the maximum, also varies considerably. In turn, this effects the physical nature of the final oxide microspheres. The role of electron microscopy and electron diffraction as applied to a specific problem of chemical technology involving the morphology of praseodymium and europium hydroxide sols is discussed. The information obtained has pointed the way to better methods of sol preparation, and thereby to final products which closely meet specifications of density and hardness. (auth)

**43182** (ORNL-TM-1508) FORMATION OF URANIUM, ZIRCONIUM, AND THORIUM OXIDE MICROSPHERES BY HYDROLYSIS OF DROPLETS. Gens, T. A. (Oak Ridge National Lab., Tenn.). July 10, 1966. Contract W-7405-eng-26. 27p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A new method of preparing metal oxide microspheres was investigated in the laboratory. This method involves spraying nitrate or chloride solutions or sols onto a layer of organic liquid floating on ammonium hydroxide solution. Droplets of sol or solution disperse in the organic layer and fall into the ammonium hydroxide, where they hydrolyze to hydroxide microspheres. The hydroxide microspheres are dried and fired to form oxide microspheres. The most successful preparation involved making gels by bubbling ammonia through aqueous solutions, converting the gels to sols by warming, and adjusting the temperature of the sol so that the viscosity was that needed for forming droplets in the organic liquid. Urania and zirconia microspheres with densities up to 99% of theoretical were formed by this method. Sols prepared from chloride salts behaved the same as those prepared from nitrate salts. However, sols prepared from uranium nitrate solution were not stable and it was necessary to use the chloride salt in making urania microspheres. (auth)

**43183** (RL-SEP-729(Rev.)) MULTI-COLUMN ION EXCHANGE PURIFICATION-CONCENTRATION PROCESS FOR AMERICIUM. Kingsley, R. S. (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Oct. 1965. Contract AT(45-1)-1350. 43p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A four-column ion exchange purification process was demonstrated in the laboratory for Am purification from a synthetic Americium Recovery Facility product containing gross amounts of the transition, alkaline earth, and rare earth metals as impurities. Typical analyses of the solvent extraction product found in the laboratory demonstration runs is 0.6 $\underline{M}$ $HNO_3$, 40 to 50 mg/l Am, 0.0004 $\underline{M}$ $Al^{3+}$, 0.005 $\underline{M}$ $Mg^{2+}$, 0.003 $\underline{M}$ $Ca^{2+}$, and 0.002 $\underline{M}$ $Fe^{3+}$. Emission spectrographic results showed that the $AmO_2$ prepared from the final demonstration run product was 90% pure. Principal impurities were 1% La, 10% Ce, and 0.1% Ca. A description of the steady state flowsheet for the dibutyl butylphosphonate recovery of Am is appended. (P.C.H.)

**43184** (UCRL-17064) MEASUREMENT OF ELECTRON SPIN RELAXATION TIMES OF IONS IN AQUEOUS SOLUTION. McCain, Douglas Clayton (Lawrence Radiation Lab., Univ. of California, Berkeley). Aug. 1966. Contract W-7405-eng-48. 138p. ORAU.

Thesis.

A new type of spectroscopy is described which uses dynamic nuclear polarization (DNP) as a signal to measure the amount of power saturation in an electron spin resonance (ESR) system. This DNP spectrometer responds only to the saturation parameter, and not to the total amount of power absorbed by the electron spin system. It is therefore more sensitive for the determination of $T_1$, the longitudinal or electron spin-lattice relaxation time, than straight detection in an ESR spectrometer, but it has the limitation that it may only be used with certain liquid solutions. Electron relaxation times, $T_1$, as short as $10^{-10}$ seconds can be measured. The DNP spectrometer was used to measure relaxation times of vanadyl, cupric, chromic, and gadolinium ions in aqueous solution. Good agreement was obtained in comparisons of these experimental results with theoretical predictions of others. Linewidths measured by conventional ESR spectroscopy were used to study the reaction rate constants and complex ion stability constants of manganous ion in aqueous solution with bromide, iodide, fluoride, and sulfate ions. Similar linewidth measurements were made on solution containing both the nitrosodisulfonate anion and other paramagnetic species. Some types of interaction between paramagnetic species in solutions are discussed. (auth)

**43185** (ZFK-WF-25) DIE AUSFAELLUNG VON URANDIOXYD AUS ALKALICHLORIDSCHMELZEN. (The Precipitation of Uranium Dioxide From Alkali Chloride Melts). Naumann, Dieter; Burk, Werner; Tschirne, Georg; Heyne, Werner; Ross, Richard (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (East Germany)). June 1962. 28p. Dep. mn.

The oxidation pattern of the reaction U(IV) → U(VI) and the hydrolysis reaction were investigated to determine the optimum precipitation conditions for the preparation of uranium dioxide for alkali metal chloride melts. After quantitative oxidation of U(IV) to $UO_2Cl_2$ the reaction $UO_2Cl_2 + 2Na^+ + 2Cl^- + O_2 \leftrightharpoons Na_2UO_4 + 2Cl_2$ leads to the formation of an insoluble uranate. By increasing the temperature of the melt the rate of complete oxidation of tetravalent uranium to hexavalent uranium was increased. In the presence of sufficient quantities of moisture, hydrolysis reaction also occurred yielding $UO_2$. Condensation of the monouranate to the di- and triuranates occurred in the melt with subsequent decomposition. The thermal stability of $UOCl_2$ was tested in alkali chloride melts. Pure $UOCl_2$ decomposed at 700°C in NaCl−KCl melts almost completely to $UCl_4$ and $UO_2$. With sufficiently low water vapor, intermediate hydrolysis products occurred which had a constant composition over a wide precipitation range. The precipitation conditions were established with respect to the U concentration of the melt and the precipitation temperature. It was shown that a dense and large-grain material can be obtained at a concentration of 100 to 250 mg U/g melt at 700°C. The reducing precipitation gave larger grain powder with Co than with $H_2$. The hydrolytic precipitation produced sufficiently thick $UO_2$ powders when there was a relatively high water vapor concentration. (J.S.R.)

**43186** (ORNL-tr-1344) CONTINUOUS CALCINATION OF MOLYBDENUM SOLUTIONS. II. CHEMICAL TESTS. Sombret, C.; Brossard, J. P. Translated by R. G. Mansfield (Oak Ridge National Lab., Tenn.), from report SCCI-50. 53p. Dep. mn. JCL $5.60 fs, $1.79 mf.

The new version of the continuous calciner was used in studies on the calcination of phosphomolybdate solutions, which are noncalcinable by reason of formation of a pasty ring at the interior of the apparatus. Attempts to break up this ring by introduction of suitable substances were made by: calcination with addition of substances which are inert at the temperature used (non decomposable salts), or of substances giving rise to inert oxides; and calcination with simultaneous introduction of the solution and of a vitrified frit of composition compatible with the later preparation of molybdate glass. The maximum duration of each test did not exceed 30 hours (cumulative daily work, the feed solution being stopped during the night). The first series of tests showed the unfavorable effects of calcium, indifferent ones of aluminum, and beneficial ones for iron. The best results were obtained with addition of iron to the solution in a quantity equal to or greater than 20 g/l. In the second series, some of the experiments were carried out with introduction of a frit in the form of a slurry; others in the form of granules. This latter technique, although necessitating a specially adapted apparatus, appears promising. (P.C.H.)

**43187** THE CRYSTAL STRUCTURES OF $Mo_2As_3$ AND $W_2As_3$. Jensen, Per; Kjekshus, Arne; Skansen, Terje (Univ., Oslo). Acta Chem. Scand., 20: 1003-15(1966).

The compounds $Mo_2As_3$ and $W_2As_3$ were found to be isostructural. Cell dimensions, as well as observed and calculated structure factors, are tabulated. The $Mo_2As_3(W_2As_3)$ structure is discussed in relation to the general (8-N) rule. (J.G.B.)

**43188** THE CRYSTAL STRUCTURE OF $Nb_{16}W_{18}O_{94}$, A MEMBER OF A $(MeO)_xMeO_3$ FAMILY OF COMPOUNDS. Sleight, Arthur W. (Univ. of Stockholm). Acta Chem. Scand., 20: 1102-12(1966).

The structure of a compound with the ideal formula $Nb_{16}W_{18}O_{94}$ was determined from single crystal x-ray data. The actual composition of the crystal used is believed to be $0.4NbO_{2.5} \cdot 0.6WO_3$. The space group is $P2_12_12$ with the unit-cell dimensions: a = 12.251 Å, b = 36.621 Å, and c = 2.94 Å. The structure is very similar to that of tetragonal potassium wolfram bronze, $K_xWO_3$, and belongs to a family of the general formula $(MeO)_xMeO_3$ where (MeO) has replaced the potassium in the pentagonal tunnels. Nonstoichiometry and results at other compositions in the $Nb_2O_5-WO_3$ and $Ta_2O_5-WO_3$ systems are discussed. (auth)

**43189** HYDROLYSIS CONSTANT OF QUADRIVALENT CERIUM FROM SPECTROMETRIC MEASUREMENTS. Offner, H. G.; Skoog, D. A. (Stanford Univ., Calif.). Anal. Chem., 38: 1520-1(Oct. 1966).

The hydrolysis of quadrivalent cerium in acid solutions was studied by an optical absorbance technique. Equations were derived relating the measured absorbance values to the hydrolysis constant, and the latter was then calculated from the experimental data. From the Beer's law behavior of solutions of varying ceric concentrations, it was concluded that polymerization reactions did not occur over the concentration range studied. (auth)

**43190** SOME RECENT DEVELOPMENTS IN THE CHEMISTRY OF TRANSITION METAL OXOCATIONS. Selbin, J. (Louisiana State Univ., Baton Rouge). Angew. Chem. Int. Ed. Eng., 5: 712-22(Aug. 1966).

The range of stability of transition metal oxocations in aqueous solution is discussed. Species with a metal-oxygen bond of order higher than unity are particularly interesting. Bond orders can sometimes be determined from bond lengths and angles, but generally only by infrared spectroscopy. The frequency range of the metal-oxygen stretching vibration, previously assumed as about 900−1100 $cm^{-1}$, must according to these investigations be extended at least to 780 $cm^{-1}$ if all multiple bonds, particularly those in trans-dioxo complexes, are to be included. Broad bands down to 650 $cm^{-1}$ are ascribed to metal-oxygen bridges. The existence of cations such as $ZrO^{2+}$ and $VO_2^+$, or of the titanyl ion, $TiO^{2+}$, has never been proved. In many cases polynuclear, oxygen-bridged oxometal species must be assumed. (184 references) (auth)

**43191** PREPARATION AND X-RAY INVESTIGATION OF HIGHER URANIUM NITRIDES. Berthold, H. J.; Delliehausen, C. (Univ., Mainz). Angew. Chem. Int. Ed. Eng., 5: 726(Aug. 1966).

The compositions of various nitrides that can be obtained from metallic uranium and nitrogen at 1 atm pressure were studied. Between 470 and 1000°C, seven nitrides $(UN_x)$ were obtained with x ranging from 1.74 to 1.55. The lattice constants of the nitrides decreased linearly with increasing nitrogen content. All the nitrides had the body-centered cubic $Mn_2O_3$ structure. (J.G.B.)

**43192** CHEMICAL PROPERTIES OF ELEMENT 104. Zvara, I.; Chuburkov, Yu. T.; Tsaletka, R.; Zvarova, T. S.; Shalaevskii, M. R.; Shilov, B. V. At. Energ. (USSR), 21: 83-4(Aug. 1966). (In Russian).

A method of rapid separation of the third and fourth groups in the periodic table was used for comparing the properties of californium, curium, and hafnium chlorides with those of the $^{260}104$ isotope. The chemical properties of the $^{260}104$ isotope differ from those of the actinide elements and are similar to those of hafnium. It was found that the atomic number of the new nucleus is correct and that it belongs to the fourth group in the periodic table. Experiments recorded 12 atoms of the $^{260}104$ isotope. (R.V.J.)

**43193** MEASUREMENT OF THE EFFECTIVE IONIZATION ENERGY IN GASES. Schulze, K. P. (Institut fuer Angewandte Physik, Hanover). Atomkernenergie, 11: 397-403(1966). (In German).

The effective ionization energy (W), the average energy expenditure to produce an ion pair by absorption of ionizing radiation, gives the important conversion factor between the dose units Roentgen and rad. A method is proposed to determine the uncertainty of the various existing values of W in the range below 50 kev. It is applicable to any gas. A detector containing counting gas of 8 atm is used as a proportional counter to measure energy and as an ionization chamber to measure charge under constant conditions for geometry and absorption of the radiation. Only electropositive gases may be examined directly, while electronegative gases must be examined by a measurement relative to a known electropositive gas of the same average atomic number in an ionization chamber. An accuracy of 2% was obtained. W was measured in air, $CO_2$, Ar, $CH_4$, and Ar−$CH_4$ mixtures, and proved to be independent of energy in the examined range of 5−50 kev. The value for air was found to be 33.9 ev/ion pair in good agreement with previously reported values $33.7_3$ and $33.8_4$ ev/ion pair. (auth)

**43194** KINETIC STUDIES OF THE OXIDATION OF URANIUM IODIDES BY OXYGEN. Handa, Muneo (Japan Atomic Energy Research Inst., Tokyo). Bull. Chem. Soc. Jap., 39: 1869-73(Sept. 1966).

The kinetics of the oxidations of uranium tetraiodide and of triiodide by oxygen were studied at temperatures from 55.0 to 66.5°C and from 88.5 to 103.5°C, respectively. The experiments were carried out with an apparatus in which the column of a gas chromatograph was replaced by an electric furnace and traps of water vapor, oxygen, and iodine. Most of the experiments were performed with the same partial pressure of oxygen (64 mm Hg) and total flow rate (60 ml per min). The activation energies for the reaction of oxygen with uranium tetraiodide and triiodide were, respectively, 21.2 and 22.5 kcal per mole. The rate of the formation of uranium trioxide was in agreement with the kinetics to be expected for reaction between a gas and a solid at a continuously diminishing spherical interface. (auth)

**43195** SALINE WATER DEMINERALIZATION AND NUCLEAR ENERGY IN THE CALIFORNIA WATER PLAN. Calif., Dep. Water Resources, Bull. No. 93, 1-145(Dec. 1960).

The various phases of the state of California's interest in nuclear energy and water demineralization as initiated through the work of two legislative subcommittees are described. The history, principal demineralization techniques, present and probable future water costs, and research and development programs, both state and federal, are described and discussed. The present status and future possibilities of nuclear energy applications are reviewed and discussed. The effect of nuclear energy in the coming 10 to 15 years on the California Water Plan is considered in detail. The types and possible use of so-called "nonconventional" sources of energy are reviewed and discussed, and their use in relation to the water program in the near future is discussed. The future program of the state in the development of water demineralization and nuclear energy applications is presented. Many tables and graphs are used to elucidate the various aspects of the report. (B.L.M.)

**43196** PHOTOLYSIS OF GROUP VI HYDRIDES. I. SOLID $H_2S$, $H_2S_2$, AND $D_2S$. **Stiles, D. A.; Tyerman, W. J. R.; Strausz, O. P.; Gunning, H. E. (Univ. of Alberta, Edmonton, Can.). Can. J. Chem., 44: 2149-55(Sept. 15, 1966).**

The primary photochemical step occurring in solid $H_2S$, $D_2S$, or $H_2S_2$ was shown to be loss of a hydrogen or deuterium atom. Electron spin resonance spectra are assigned to HS, DS, and $HS_2$, which were not previously detected in the solid phase, and behavior of these radicals on warming the samples is described. When $H_2S$ and $D_2S$ matrices were warmed from 77 to 125°K, the HS and DS spectra collapsed into a doublet and singlet respectively. The hyperfine splitting in HS increased and both signals appeared at lower average g-values than when anisotropically broadened at 77°K. (auth)

**43197** INTERSYSTEM CROSSING OF THE ELECTRONICALLY EXCITED DIDEUTEROETHYLENE MOLECULES FORMED IN BENZENE PHOTOSENSITIZATION. **Terao, Terumi (Tokyo Inst. of Tech.); Hirokami, Shunichi; Sato, Shin; Cvetanovic, R. J. Can. J. Chem., 44: 2173-80(Sept. 15, 1966).**

Experimental evidence is presented for a rapidly occurring intersystem-crossing of electronically excited dideuteroethylene molecules initially formed in the benzene-photosensitized reaction at 2,537 Å and 25°C to another excited state which is responsible for the internal H-atom scrambling. The mechanism is entirely analogous to that previously postulated for the photoexcited states sensitized by Hg ($^3P_1$) atoms but the rate constants for intersystem crossing and molecular decomposition are drastically decreased as a result of the smaller amount of energy available for the excitation. (auth)

**43198** DEVELOPMENT AND PRODUCTION EXPERIENCE WITH MECHANICALLY AGITATED FLUID BEDS AS APPLIED TO THE HYDROFLUORINATION OF FINE URANIUM OXIDE POWDERS. **Brater, D. C.; Castro, D. L.; Dean, L. A.; Pashley, J. H.; Smiley, S. H. Chem. Eng. Progr. Symp. Ser. Pt. 15, 62: 1-11(1966).**

Use of a mechanically agitated fluid-bed reactor for the conversion of $UO_2$ to $UF_4$ by reaction with gaseous HF has increased greatly the processing rate and conversion efficiency of a production facility. Experimental work leading to the development of the reactor and plant performance is discussed. (auth)

**43199** FLUIDIZED BED RECOVERY OF FLUORINE IN THE MANUFACTURE OF $UF_6$. **Pedigo, W. R.; King, C. R.; Dean, L. A.; Owen, J. E.; Bernstein, S. Chem. Eng. Progr., Symp. Ser. Pt. 15, 62: 12-19(1966).**

A method was developed using a fluid bed reactor for the recovery of fluorine from process gas steams associated with the manufacture of $UF_6$. The all-Monel reactor employs a bed of $UF_4$ and operates at temperatures in the range of 700 to 750°F. Fluorine recovery is based on the reaction between fluorine and $UF_4$ at these temperatures to form $UF_6$ and intermediate uranium fluorides ($U_2F_9$, $U_4F_{17}$, etc.). The system has demonstrated a fluorine recovery efficiency in excess of 98%. Design features and current operational experience are presented, along with a review of the economic factors leading to the reactor installation. (auth)

**43200** REDUCTION AND HYDROFLUORINATION OF URANIUM CONCENTRATES BY FLUID BED TECHNIQUES. **Sutton, Alan H.; Bishop, Jerry C.; Cohen, Morton H.; Stahman, Kenneth J. Chem. Eng. Progr., Symp. Ser. Pt. 15, 62: 20-30(1966).**

Five years of production operation experience on fluidized bed reductors and hydrofluorinators in an integrated continuous processing of impure uranium concentrates is summarized. Particle-size and temperature control are essential to proper operation. Filters and electrical heaters are the major mechanical items subject to failure in the reduction process, and mechanical maintenance of solids-transfer equipment plus filter maintenance are predominant in hydrofluorination equipment. (auth)

**43201** METHOD FOR PREDICTION OF PERCENTAGE CONVERSION IN TWO-STAGE FLUID-BED HYDROFLUORINATION SYSTEMS. **Pashley, J. H. (Oak Ridge Gaseous Diffusion Plant, Tenn.). Chem. Eng. Progr., Symp. Ser. Pt. 15, 62: 31-42(1966).**

A method of correlating laboratory data for conversion of $UO_2$ to $UF_4$ to predict product conversion is discussed. The method utilizes the two-parameter logarithmic probability function. Reactor calculations are performed by Gaussian summation of results for predetermined residence times based on the residence-time function for a well-mixed bed. The calculation method includes provision for adjustment of the argument of the probability function to compensate for variation of the hydrogen fluoride driving force determined for average bed conditions. A fictitious time is estimated for partially converted feed and also is used to adjust the argument of the probability function. Estimated effects of variation of reaction parameters are given, which allow evaluation of potential results for variation of plant conditions and for changes in material fed. The computer program is described briefly. (auth)

**43202** USE OF FLUID BED EQUIPMENT IN ENRICHED URANIUM PROCESSING. **Heidt, H. M.; Levey, R. P.; Hamrin, C. E. (Union Carbide Corp-Nuclear Div., Oak Ridge, Tenn.). Chem. Eng. Progr., Symp. Ser. Pt. 15, 62: 43-51(1966). (Y-DA-523).**

In process development work with cold enriched (fission-free) uranium streams, the (neutron) criticality, material value, and safety must be considered in addition to ordinary design variables. Three specialized contactors embodying specific process characteristics were developed for this work. Two of these, a tapered-bed reactor and a pulsed-bed reactor, were developed and their operating characteristics are known. A high-temperature reactor for use at 2,300°C was evolved; however, this unit is presently in the development phase and no operational data are available. (auth)

**43203** ADVANCES IN SCANDIUM CHEMISTRY. **Petru, Frantisek; Hajek, Bohumil (Vysoka Skola Chemicko-Technologicka, Prague). Chem. Listy, 60: 721-32 (1966). (In Czech).**

The literature (82 references) on scandium is reviewed.

Its occurrence in nature in various minerals is summarized, and methods for concentrating it in ore fractions and separating it from associated tungsten, zirconium, etc., are mentioned. Decomposition or hydrolysis of $Sc_2(SiF_6)_3$ gives $ScF_3$. Metallic scandium may be produced by electrolysis of the chloride or reduction of the fluoride or chloride with calcium or zinc, in an argon atmosphere, for example. At 1600°C and $10^{-4}$ mm Hg, metallic scandium may be sublimed. The oxide, fluoride, other halide, carbide, and silicate compounds are discussed, together with scandium salts of several inorganic and organic acids. The oxide and other compounds of scandium act catalytically in various reactions, for example, in the conversion $CH_3COOH$ to $CH_3COCH_3$, in making propanol, and in converting dicarboxylic acids to ketones and cyclic compounds. (TTT)

**43204** NEW COMPLEXANS. VI. ON THE STABILITY CONSTANTS OF COMPLEXES OF RACEMIC 2,3-DIAMINOBUTANE-N,N,N',N'-TETRAACETIC ACID WITH LANTHANIDES, DETERMINED BY THE POLAROGRAPHIC METHOD FOR THE EXCHANGE EQUILIBRIA. **Novak, Vladimir; Svicekova, Maria; Majer, Jaroslav (Univ. Komenskeho, Bratislava). Chem. Zvesti, 20: 252-60 (1966). (In Slovak).**

Logarithms of the stability constants for complexes of DBTA with lanthanides are reported at ionic strength 0.10 ($KNO_3$) and 20°C. Numerous (42) exchange systems were used to evaluate the constants; in this way the precision and accuracy of the determination are considered and checked. The constants were found to be: La, 16.68 ± 0.21; Ce, 17.21 ± 0.19; Pr, 17.49 ± 0.15; Nd, 17.70 ± 0.16; Sm, 18.32 ± 0.15; Eu, 18.61 ± 0.14; Gd, 18.84 ± 0.14; Tb, 19.45 ± 0.13; Dy, 19.93 ± 0.13; Ho, 20.27 ± 0.14; Er, 20.68 ± 0.16; Tm, 20.96 ± 0.18; Yb, 21.29 ± 0.20; and Lu, 21.33 ± 0.20. These are compared with the values for meso-DBTA, EDTA, and DCTA complexes of the lanthanides. The plot of log of the stability constant vs atomic number rises more steeply than that for meso-DBTA, and the complexes are two to three log units more stable. The stability constants are comparable to those for DCTA. The greater error of the constants is in part due to the inaccuracy with which the value for the Cd-rac-DBTA complex, taken as standard, is known. (BBB)

**43205** POLAROGRAPHIC STUDY OF REDUCTION AND DISMUTATION OF URANIUM IN AQUEOUS SOLUTIONS OF ACETYLACETONE. Branica, M.; Kuta, J. (Inst. Ruder Boskovic, Zagreb. Heyrovsky Inst. of Polarography, Prague). Collect. Czech. Chem. Commun., 31: 2833-40(July 1966).

The first one-electron reduction wave of uranium(VI) in acetylacetone solutions at pH 1 corresponds to the reduction of free uranyl ion at pH 3.5 of the monoacetylacetonato- and at pH 7 of the bisacetylacetonato-complex. The limiting current of the second wave occurring at 3.5 is kinetically controlled and increases with the concentration of uranium to the maximum value of about 75% of the first wave. For the first and the second wave a possible scheme is given including both the electrode reactions of uranium(VI) and the dismutation of the acetylacetonato-complexes of uranium(V). The influence of surface active substances on the first and the second wave at different pH values was studied by means of the d-c polarography and the i-t curves. The obtained inhibition effect is explained by a specific influence of surface active substances on the electrode reactions if the different uranyl species participate in the electrode reaction. (auth)

**43206** COMPARISON OF FLUORINE COMPOUNDS OF HAFNIUM AND ZIRCONIUM. Gaudreau, Bernard (Laboratoire de Chimie Minerale, Paris). Compt. Rend., Ser. C, 263: 67-70(July 4, 1966). (In French).

The great analogy of compounds of hafnium and zirconium is confirmed. X-ray diffraction makes it possible to distinguish the fluorine compounds. (tr-auth)

**43207** MAGNETIC STUDY OF SULFIDES AND OXYSULFIDES OF URANIUM AND POTASSIUM. Padiou, Jean; Lucas, Jacques (Univ., Paris, Rennes, France). Compt. Rend., Ser. C, 263: 71-3(July 4, 1966). (In French).

A study of the magnetic susceptibility of the double sulfides and the oxysulfides of uranium and potassium shows that uranium is tetravalent in $K_2U_2O_2S_5$ with the effective moment $\mu_{eff} = 2.83$ and $K_2U_2O_2S_3$ with $\mu_{eff} = 2.81$ and trivalent in KUOS with $\mu_{eff} = 3.25$ and $KUS_2$ with $\mu_{eff} = 3.40$; the latter, below 160°K, behaves as a ferromagnetic compound. (tr-auth)

**43208** FLUORINE MAGNETIC RESONANCE SHIFTS IN PARAMAGNETIC $PuF_4$. **Pintar, M.; Porok, J.; Slivnik, J. (Inst. Jozef Stefan, Ljubijan, Yugoslavia).** Croat. Chem. Acta, 38: 61-2(1966).

The low resolution $^{19}F$ NMR absorption of powder $PuF_4$ was measured in the range from 30 to −150°C. Linear dependence of ΔH/H against 1/T and the second moment against $1/T^2$ (T in $K^0$) over the temperature range 30 to −56°C confirmed paramagnetic origin of the $^{19}F$ absorption asymmetry. (auth)

**43209** ISOTOPE SHIFTS ($C\,^{32}S-C\,^{34}S$) IN THE BANDS OF THE $A\,^1\Pi-X\,^1\Sigma^+$ SYSTEM OF CS. Narasimham, N. A.; Gopal, Kum. Sheila (Atomic Energy Establishment, Trombay, India). Curr. Sci. (India), 35: 485(Oct. 5, 1966).

Vibrational isotope shifts in the emission bands of the ultraviolet system of the CS molecule were studied. Spectra of $C\,^{32}S$ and $C\,^{34}S$ were excited in an electrodeless, microwave oscillator discharge through sulfur, enriched to 44% of $^{34}S$, and photographed at a dispersion of 0.89 Å/mm. The $R_1$ heads of both isotope molecules were measured and their differences, in vacuum wave numbers, are given. The isotopic shifts for the bands were collected. (D.H.M.)

**43210** FLUORESCENCE OF LANTHANUM IONS IN AQUEOUS SOLUTIONS. PART I. RESEARCH ON THE IMPROVEMENT OF CONDITIONS TO OBTAIN MAXIMUM FLUORESCENCE INTENSITY OF LANTHANUM IN SODIUM TUNGSTATE SOLUTIONS. Alberti, Giulio; Massucci, Maria Antonietta (CNEN, Rome. Univ., Rome). Gazz. Chim. Ital., 95: 997-1005(1965). (In Italian). (RT/CHI(66)-3).

The effects of pH, sodium tungstate concentration, temperature, and time on lanthanide fluorescence intensities were determined. It was found that the variation of the fluorescence intensity was related to the formation of equilibria that led to polinuclear species of the sodium tungstate. The internal filter action of these polinuclear species on the fluorescence excitation wavelength was determined. (auth)

**43211** FLUORESCENCE OF LANTHANUM IONS IN AQUEOUS SOLUTIONS. PART II. FLUORESCENCE ABSORPTION SPECTRA IN SODIUM TUNGSTATE SOLUTIONS. Alberti, Giulio; Massucci, Marie Antonietta (CNEN, Rome. Univ., Rome). Gazz. Chim. Ital., 95: 1006-20(1965). (In Italian). (RT/CHI(66)-4).

It was found that in a 0.6$\underline{M}$ sodium tungstate solution buffered to pH 9, samarium, europium, terbium, and dysprosium ions exhibit a fluorescence $10^4$ to $10^5$ greater than in solutions of the usual mineral acids. The other lanthanide ions do not show appreciable fluorescence under these conditions. Studies on the fluorescence spectra showed that emission is due to transitions between the 4f energy levels of the trivalent lanthanide ions. All trivalent lanthanide ions in solution exhibit broad and rather intense absorption band in the uv region, with a maximum at 265 mμ. This maximum corresponds to the best excitation wavelength for the trivalent lanthanide ions in tungstate solution. The fluorescent properties of lanthanide ions in tungstate solution are compared with those in hydrochloric acid solutions, and solid tungstate media. The observed phenomena are discussed and connected to the transfer of absorbed energy at 265 mμ from the tungstate ions to the trivalent lanthanide ions, which reemit this energy as visible light. (auth)

**43212** FLUORESCENCE OF LANTHANUM IONS IN AQUEOUS SOLUTIONS. PART III. FLUORESCENCE

ABSORPTION SPECTRA IN POTASSIUM OXALATE SOLUTIONS. Alberti, Giulio; Bruno, Roberto; Massucci, Maria Antonietta; Saini, Alberto (CNEN, Rome. Univ., Rome). Gazz. Chim. Ital., 95: 1021-30(1965). (In Italian). (RT/CHI(66)-5).

The optimum conditions for maximum fluorescence intensity of trivalent lanthanide ions in potassium oxalate solution were determined. It was found that in a 0.01M oxalate solution (buffered to pH 7.8) terbium is the most fluorescent lanthanide ion. Europium and dysprosium are also fairly fluorescent in such a solution whereas the remaining lanthanides, with exception of samarium, which produces a very low fluorescence, do not exhibit appreciable fluorescence. From the determination of the excitation and emission spectra of fluorescence it was shown that the best excitation wavelength is identical for all the fluorescent lanthanide ions, and that the emission is due to transitions between the 4f energy levels. The fluorescent properties of lanthanide ions in oxalate solution are compared with those exhibited in hydrochloric acid and sodium tungstate solutions. The observed phenomena are related to an intramolecular energy transfer. (auth)

**43213** SYNTHESIS OF MOLYBDENUM AND TUNGSTEN BRONZES AT HIGH PRESSURE. Bither, T. A.; Gillson, J. L.; Young, H. S. (E. I. du Pont de Nemours and Co., Wilmington, Del.). Inorg. Chem., 5: 1559-62 (Sept. 1966).

Molybdenum bronzes $Na_{0.90-0.97}MoO_3$ (cubic), $K_{0.89-0.93}MoO_3$ (cubic), $K_{\sim 0.5}MoO_3$ (tetragonal I), and $Rb_{0.27}MoO_3$ (hexagonal), isotypic with known tungsten bronzes, were prepared at 65 kbars pressure. The cubic and tetragonal phases arc metallic conductors like their tungsten analogs, but the hexagonal bronze shows semiconductor behavior. In addition, an orthorhombic $Rb_{0.41-0.44}MoO_3$ (semiconductor) and the previously unreported cubic $K_xWO_3$, as well as a monoclinic $Na_2Cr_3O_9$ phase (insulator), were made under the same conditions. (auth)

**43214** PREPARATION AND SOME PROPERTIES OF $Nd_2O_2C_2$. Butherus, A. Duane; Leonard, Ralph B.; Buchel, Gerald L.; Eick, Harry A. (Michigan State Univ., East Lansing). Inorg. Chem., 5: 1567-71(Sept. 1966).

The results of hydrolysis experiments, x-ray-powder diffraction data, and some thermodynamic properties of a phase in the neodymium−oxygen−carbon system of the approximate composition $Nd_2O_2C_2$ are reported. (auth)

**43215** COMPLEXES OF TRIVALENT LANTHANIDE IONS. III. BIDENTATE CHELATES. Choppin, Gregory R.; Friedman, H. George Jr. (Florida State Univ., Tallahassee). Inorg. Chem., 5: 1599-1603(Sept. 1966).

The enthalpy and entropy of complexation are reported in an ionic strength of 2.00 M ($NaClO_4$) for lanthanide ions with glycolate, lactate, and α-hydroxyisobutyrate ligands. The complexes were found to be stabilized by both the enthalpy (exothermic) and the entropy (positive). Interpretations of these thermodynamic values are offered in terms of the increasing basicity of the α-hydroxyl group and the inclusion of a water molecule in the chelate ring between the metal ion and the α-hydroxyl group. (auth)

**43216** THE BASIC EXCHANGE HYDROGEN REACTION OF SOME NITROUS HETEROCYCLES IN LIQUID AMMONIA: KINETICS, RELATION WITH ELECTRON STRUCTURE, MECHANISM. Tupitsyn, I. F.; Semenova, N. K.; Zatsepina, N. N.; Musakin, A. A. Isotopenpraxis, 2: 23-32(Jan. 1966). (In Russian).

The reactivity of the different positions of the aromatic ring of pyridine, quinoline, acridine, and phenazine was investigated in the deutero-exchange reaction with $NH_2$ + $NH_3$ (liq.) solution. The rate constants of exchange vary: for pyridine 4 > 3 > 2, for quinoline 4 > 3 > 2 > 8 > 6, for for acridine 10 > 2 to 9. The activation parameters (E, lg A) were calculated. Kinetic isotope effects were measured for the exchange reaction of hydrogen atoms in position 2($K_D/K_T$ = 1.1 to 1.4) and in position 3($K_D/K_T$ = 2.0 to 2.2). The results are discussed in terms of the possible effect of the nucleophylic addition of the $NH_2^-$-ion to C-atom in position 2 on the isotopic exchange reaction. The kinetics of hydrogen exchange in the molecules of toluene, α- and β-picoline with the $NH_2^-$ + $NH_3$ (liq.) solution were studied. The changing of the rate constants in $CH_3$-groups: β-picoline > toluene > α-picoline did not correspond to the order of their chemical activity changes. The kinetic isotopic effect ($K_D/K_T$ = 2.4 to 2.8), secondary α-deuterium isotopic effect ($K_{CH_2D}/K_{CD_3}$ = 1.4 to 1.6) and the isotopic effect of the solvent were observed by the hydrogen isotopic exchange of $CH_3$-groups. The experimental data are satisfactorily explained in terms of the carbanionic mechanism that takes into account possible decreasing of the exchange rate of the $CH_3$-group in the α-picoline molecule due to the formation of the ion pair ($R-CH_2^-K^+$) with low exchangeability. This ion pair is the product of the parallel metallation reaction. (auth)

**43217** RARE EARTH PERRHENATES. Plyushchev, V. E.; Varfolomeev, M. B. (Moscow Inst. of Fine Chemical Tech.). Izv. Akad. Nauk SSSR, Neorg. Mater., 2: 899-906(May 1966). (In Russian).

Perrhenates of the rare earths and yttrium were synthesized with the compositions $M(ReO_4)_3 \cdot 4H_2O$ (M = La, lanthanides, and Y), $M(ReO_4)_3 \cdot 2H_2O$ (M = the elements in the series Tb to Lu and Y), and $M(ReO_4)_3 \cdot H_2O$ (M = the elements in the series La to Gd) and the anhydride $M(ReO_4)_3$. All the compounds synthesized were identified by chemical, optical, and x-ray analysis and infrared spectroscopy; their densities were determined. The thermal stability of the crystal hydrates was studied by isothermal dehydration, thermography, and thermogravimetry. The scheme for their transition to the anhydrides was explained. The crystal structure of $M(ReO_4)_3 \cdot 4H_2O$ and the space groups of compounds of this type were determined. The thermal stability of $M(ReO_4)_3$ was investigated, and the relation lg p − $10^3$/T was established for the perrhenate anhydrides. Solubility was determined at 25°C and provisional values of the fusion temperatures of $M(ReO_4)_3$ were found. Isostructural high-temperature modifications exist for $M(ReO_4)_3$ in the series Eu to Lu and Y for temperatures above 570°C. (tr-auth)

**43218** INFRARED SPECTRA OF RARE-EARTH PYROGERMANATES AND THE STRUCTURE OF $Ge_2O_7$ ANIONS. Tenisheva, T. F.; Lazarev, A. N.; Bondar, I. A.; Vinogradova, N. V. (Grebenshchikova Inst. of Silicate Chemistry, Academy of Sciences, SSSR). Izv. Akad. Nauk SSSR, Ser. Khim., No. 10, 1764-71(1965). (In Russian).

The types of crystal structures formed by the rare earth element pyrogermanates were determined from their ir spectra, and the structures of these rare earth pyrogermanates and pyrosilicates were compared. Three structural types of pyrogermanates were established: type I− La; type II−Pr, Nd, Sm, Gd; type III−Dy, Y, Er, Yb. The shift, in comparison to pyrosilicates, of the stability limits of each type of structure was attributed to the increased distance between the oxygen atoms in the germanate tetrahedra. The valence angle of GeOGe in the $Ge_2O_7$ anion increases in going from type I to the type II and III pyrogermanates. As with the pyrosilicate SiOSi angle, the increase in the GeOGe angle is associated with a decrease in the ion radius, reduction in the basicity of the cation and increase in the covalency of the $Ln^+-O^-$ (Ge) bond. (ATD)

**43219** INFRARED SPECTRA AND THE STRUCTURE OF RARE-EARTH PHOSPHATES AND SULFATES. Tenisheva, T. F.; Pavlyukevich, T. M.; Lazarev, A. N. Izv. Akad. Nauk SSSR, Ser. Khim., No. 10, 1771-8(1965). (In Russian).

The infrared spectra of anhydrous orthophosphates and sulfates of the rare earth elements were investigated in the area of valence oscillation frequencies of the anion. An interpretation of the spectra is given. The existence of two types of structure of the compounds $LnPO_4$ and $Ln_2(SO_4)_3$ was established. A comparison of the transition point (boundary value of the ion radius) in one structure type with the other led to the conclusions of the inadequacy of a purely geometric consideration and indicated the dependence of the effective ion radius of the cations on the electron acceptor capacity of the anion. The spectra of rare earth oxysulfates indicating the existence of only one structure type, which was ascribed to the less dense packing of the structural elements of these crystals, were examined. (tr-auth)

**43220** PREPARATION AND PROPERTIES OF SODIUM ZIRCONODISILICATE $Na_2ZrSi_2O_7$. **Polezhaev, Yu. M.; Chukhlantsev, V. G.; Pivnik, L. Ya. (Urals Polytechnic Inst., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol., 9: 167-70(1966). (In Russian).**

The preparation of $Na_2ZrSi_2O_7$ crystals by recrystallization of products produced by sintering in sodium disilicate melt is described. Studies were made of the optical, chemical, and roentgenographic properties of $Na_2ZrSi_2O_7$, and it was found that the compound melts incongruently at temperature near 1480°C. (R.V.J.)

**43221** ION HYDROLYSIS OF RARE EARTHS AND YTTRIUM IN AQUEOUS SOLUTIONS. **Frolova, U. K.; Kumok, V. N.; Serebrennikov, V. V. (Tomsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol., 9: 176-9(1966). (In Russian).**

Hydrolysis constants $K_h = [MOH^{2+}][H^+]/[M^{3+}]$ of ions of rare earth elements and yttrium were measured at 25°C and at ionic strength 0.3 ($NaClO_4$). (tr-auth)

**43222** THERMODYNAMIC PROPERTIES OF RARE EARTH CHLORIDES WITH HYDROGEN AND CERTAIN METALS IN GASEOUS STATE. **Novikov, G. I.; Baev, A. K. (Leningrad State Univ.). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol., 9: 180-4(1966). (In Russian).**

The free energy ($\Delta F°$ kcal/mole) of reaction of tri- and dichlorides of rare earths with hydrogen and alkali and alkaline earth metals was computed. The reduction of rare earth metals by hydrogen at 1000 to 1900°K is endothermic. The most efficient reduction was achieved with gaseous metallic lithium. (R.V.J.)

**43223** LANTHANUM REACTIONS WITH BOROPYROCATECHIN VIOLET COMPLEX. **Serdyuk, L. S.; Silich, U. F. (Dnepropetrovsk State Univ., USSR). Izv. Vyssh. Ucheb. Zaved., Khim. Khim. Tekhnol., 9: 190-4(1966). (In Russian).**

Reactions of lanthanum with boropyrocatechin violet complex result in a lanthanum pyrocatechin violet complex with maximum absorption at $\lambda = 620$ m$\mu$. The equilibrium shift method was used to determine that the ratio of lanthanum in the complex to dye is 1 : 1. Instability constant for the lanthanum pyrocatechin violet complex and the equilibrium constant for the lanthanum reactions with boropyrocatechin violet complex were found to be $0.8 \times 10^{-5}$ and 100, respectively. (R.V.J.)

**43224** ELECTRON SPIN RESONANCE STUDY OF $^{17}O$ ENRICHED p-BENZOSEMIQUINONE ANION RADICAL. **Gulick, Wilson M. Jr.; Geske, David H. (Cornell Univ., Ithaca, N. Y.). J. Amer. Chem. Soc., 88: 4119-24(Sept. 20, 1966).**

p-Benzoquinone-7-$^{17}O$ was prepared by equilibration of p-benzoquinone with $H_2{}^{17}O$. The $^{17}O$-enriched p-benzosemiquinone (PBSQ) anion radical was generated electrochemically and the oxygen-17 isotropic coupling constant, $a_0$, was measured in various solvents. The values ranged from $-9.54 \pm 0.05$ gauss in 1,2-dimethoxyethane to $-8.70 \pm 0.05$ gauss in water. Values of $a_0$ were also measured in various acetonitrile-water mixtures. The sign of the coupling constant was determined on the basis of line-width variations. The oxygen atoms in PBSQ were found to undergo rapid exchange with water. The variation of $a_0$ with solvent composition was rationalized on the basis of $\pi$-electron spin densities calculated on the basis of $^{13}C$ and $^1H$ coupling constants for PBSQ available in the literature. (auth)

**43225** TEMPERATURE DEPENDENCE OF FLUORINE AND $^{13}C$ HYPERFINE INTERACTIONS OF HEXAKIS(TRIFLUOROMETHYL)BENZENE ANION. **Danner, J. C.; Maki, A. H. (Univ. of California, Riverside). J. Amer. Chem. Soc., 88: 4297-8(Sept. 20, 1966).**

The effects of temperature on $^{19}F$ and both $^{13}C$ hyperfine splittings of the hexakis(trifluoromethyl)benzene anion(I) were observed. (I) was produced by reducing the fluorocarbon with potassium in tetrahydrofuran in vacuo. The ESR spectra were measured and the $^{19}F$ and $^{13}C$ splittings determined. Equations are given for the linear variation of the coupling constants with temperature. (J.G.B.)

**43226** SOLUBILITY OF NIOBIC OXIDE AND NIOBIUM DIOXYFLUORIDE IN NITRIC ACID–HYDROFLUORIC ACID SOLUTIONS AT 25 DEG C. **Ferris, Leslie M. (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data, 11: 343-6(July 1966). (ORNL-P-2114).**

The solubilities of niobic oxide and niobium dioxyfluoride were determined at 25°C in hydrofluoric acid solutions that initially were up to 25$\underline{M}$ in HF and in nitric acid-hydrofluoric acid solutions that initially were up to 20$\underline{M}$ in $HNO_3$ and and 5$\underline{M}$ in HF. In all cases, the niobium concentration in the saturated solution was about one fifth the total fluorine concentration, indicating that niobium was present in these solutions primarily as the $NbOF_5^{-2}$ ion. The solid phases at equilibrium always contained $NbO_2F$, indicating that the equilibria involved were $2NbO_2F_{(s)} + 8HF_{(aq)} \rightleftharpoons 2H_2NbOF_{5(aq)} + 2H_2O$ and $Nb_2O_{5(s)} + 6HF_{(aq)} \rightleftharpoons NbO_2F_{(s)} + H_2NbOF_{5(aq)} + 2H_2O$, depending on the initial compound used. (auth)

**43227** ABSENCE OF ISOTOPE EFFECTS IN THE ABSENCE OF FORCE CONSTANT CHANGES. **Stern, Marvin J. (Yeshiva Univ., New York. Brookhaven National Lab., Upton, N. Y.); Wolfsberg, Max. J. Chem. Phys., 45: 2618-29(Oct. 1, 1966). (BNL-9949).**

Calculations were carried out to demonstrate that there is usually very little quantum-mechanical contribution to an isotope effect on a rate (equilibrium) in the absence of force constant changes, between reactant and transition state (product), at the position(s) of isotopic substitution. The usual upper limits to the deviations of such secondary isotope effects $[(k_1/k_2)(\nu_{1L}^{\ddagger}/\nu_{2L}^{\ddagger})^{-1}$ or $K_1/K_2]$ from unity, at room temperature, were estimated to be 1.5% per $\alpha$ deuterium, 0.2% per $\beta$ deuterium, and even less for heavy-atom isotopes or for deuteriums further removed from the reaction site. Some exceptional circumstances under which there may be large "no-force-constant-change" isotope effects were found. However, usually it is quite proper to interpret the existence of sizable quantum-mechanical isotope effects as indicative of force constant changes at the isotopic position(s). (auth)

**43228** KINETICS OF THE OXIDATION OF EUROPIUM(II) WITH VANADIUM(III) AND CHROMIUM(III) IN AQUEOUS PERCHLORIC ACID SOLUTIONS. **Adin, A.; Sykes, A. G. (Univ. of Leeds, Eng.). J. Chem. Soc. (London), A, No. 9, 1230-6(1966).**

The reactions of europium(II) with vanadium(III) and chromium(III) in aqueous perchloric acid solutions $\mu = 2.0\underline{M}$ were studied using conventional spectrophotometric techniques. In preliminary experiments it was found that europium(II) and chromium(II) do not react with perchlorate ions over periods of at least ten days. The slow reaction between vanadium(II) and perchlorate ions was confirmed at 25°. The reaction $Eu(II) + V(III) \rightarrow Eu(III) + V(II)$ is first order in both the reactants $d[V(II)]/dt = k_{obs}[Eu(II)][V(III)]$ where $k_{obs}$ is dependent on the hydrogen-ion concentration $k_{obs} = k_1 + k'[H^+]^{-1}$. The constant $k_1$ ($9.0 \times 10^{-3}$ l mole$^{-1}$ sec$^{-1}$ at 25°) corresponds to the reaction of $Eu^{2+}$ with $V^{3+}$ and it is assumed that k′ is for the reaction of $Eu^{2+}$ with $VOH^{2+}$. Thus k′ may be written $k_2k_H$ where $k_2$ (2.0 l mole$^{-1}$ sec$^{-1}$ at 25°) is the true rate constant and $k_H$ the hydrolysis constant for $V^{3+}$. From the temperature dependence $\Delta H_1\ddagger = 11.4$ kcal mole$^{-1}$, $\Delta S_1\ddagger = -30.1$ eu, $\Delta H_2\ddagger = 6.2$ kcal mole$^{-1}$, and $\Delta S_2\ddagger \sim -35$ eu. The forward and reverse reactions $Eu(II) + Cr(III) \underset{k_{-3}}{\overset{k_3}{\rightleftharpoons}} Eu(III) + Cr(II)$ are both slow at 25°, and with $[H^+] = 0.5\underline{N}$ $k_3 \sim 1.7 \times 10^{-5}$ l mole$^{-1}$ sec$^{-1}$ and $k_{-3} \sim 1.4 \times 10^{-5}$ l mole$^{-1}$ sec$^{-1}$. The addition of free chloride ions does not effect the forward reaction, but in the reverse the rate is much faster and substitution-inert $CrCl^+$ is formed. With $CrCl^{2+}$ as the chromium(III) reactant the forward reaction $Eu^{2+} + CrCl^{2+} \rightarrow Eu^{3+} + Cr^{2+} + Cl^-$ is also much faster. At 25° $k_4 = 2.23 \times 10^{-3}$ l mole$^{-1}$ sec$^{-1}$ and the activation parameters for this path are $\Delta H_4‡ = 17.0$ kcal mole$^{-1}$ and $\Delta S_4‡ = -13.9$ eu. A transition complex $[CrCl\ Eu]^{4+}$ seems likely, but alternatives $[CrClH_2O\ Eu]^{4+}$ and $[Cl\ Cr\ H_2O\ Eu]^{4+}$ cannot as yet be entirely excluded. (auth)

**43229** POLAROGRAPHY AND ZONE ELECTROPHORESIS OF URANYL-L-METHIONINE COMPLEXES. Lai, Tsai-teh; Cheng, Heng-shou (Cheng Kung Univ., Tainan, Taiwan). J. Electroanal. Chem., 12: 225-9(Sept. 1966).

The uranyl-L-methionine complex was studied using polarography and zone electrophoresis over the pH range 0.8–4.7 and the ligand concentration range 0.06–0.20 M at 30 ± 0.1°. Two complexes with the formulas $UO_2(OH)M_3^+$ and $UO_2(OH)_2M_2$, M denoting dipolar L-methionine ion, were confirmed at various pH-values. The effects of pH and ligand concentration on the characteristics of the current-voltage curves are discussed and the electrode reactions represented. (auth)

**43230** TRICYCLOPENTADIENYLNEPTUNIUM CHLORIDE. Fischer, E. O.; Laubereau, P.; Baumgaertner, F.; Kanellakopulos, B. (Technische Hochschule, Munich). J. Organometal. Chem., 5: 583-4(1966). (In German).

For the preparation of tricyclopentadienylneptunium chloride, $(C_5H_5)_3NpCl$, a mixture of sublimed $NpCl_4$ and $Be(C_5H_5)_2$ (0.76 mmole: 6.55 mmole) was placed in a sublimator with a Hg manometer. The portion of the vessel containing the reactants was warmed to 65 to 70°C for 4 hours and stirred. At the end of this time the reaction mixture was cooled and protected by an inert gas stream while a water-cooled cold finger was inserted; high vacuum was then applied and the temperature raised so that the unreacted $Be(C_5H_5)_2$ sublimed at 90°C. Analytically pure $(C_5H_5)_3NpCl$ sublimed at 100 to 105°C. The infrared spectrum is reported and is essentially identical to that of $(C_5H_5)_3UCl$ in number and position of bands. Thus Np behaves analogous to U, but in distinction to Pu and Am, in the preparation of products from chlorides; similar compounds were obtained from $NpCl_3$ and $NpF_3$. (BBB)

**43231** ABSORPTION SPECTRA OF OCTAHEDRAL LANTHANIDE HEXAHALIDES. Ryan, Jack L. (Battelle-Northwest, Richland, Wash.); Joergensen, Chr. Klixbuell. J. Phys. Chem., 70: 2845-57(Sept. 1966).

Hexahalide 4f group complexes were prepared in aprotic solvents such as nitriles and in triphenylphosphonium and pyridinium salts. The internal transitions in the partly filled 4f shell corresponded to absorption bands much weaker than for the corresponding aqua ions (except the hypersensitive pseudoquadrupolar transitions) and showed the vibrational structure characteristic for octahedral complexes with a center of inversion. The nephelauxetic effect was much stronger than for the same central ions in $LaCl_3$ but not as pronounced as for the oxides. The electron-transfer spectra observed in Ce(IV), Sm(III), Eu(III), Tm(III), and Yb(III) hexahalides are discussed; the apparent optical electronegativities were somewhat higher than for the analogous halide complexes in ethanolic solution. The 4f → 5d transitions observed in Ce(III) hexahalides showed that the subshell energy difference $\Delta$ is larger than 15 kK. Similar transitions in Tb(III) hexahalides seemed to involve a spin-forbidden absorption band at relatively low wavenumber and indicated slightly smaller exchange integrals K(4f, 5d) than in the isoelectronic $Gd^{+2}$. (auth)

**43232** HYDROGEN–DEUTERIUM EQUILIBRATION OVER PALLADIUM HYDRIDE. Rennard, R. J. Jr.; Kokes, R. J. (Johns Hopkins Univ., Baltimore). J. Phys. Chem., 70: 2905-8(Sept. 1966).

Equilibration of a 50 : 50 mixture of hydrogen and deuterium over palladium hydride was studied as a function of composition at −195 and −183°C. Sorption of hydrogen and deuterium occurs at these temperatures, but exchange of gas phase deuterium with palladium hydride (or vice versa) does not. The rate of equilibration decreases with increasing hydrogen content of the catalyst. It is concluded that once hydrogen adsorption occurs, exchange or incorporation follows, and that the relative rates of these two processes are independent of hydride concentration in the palladium. (auth)

**43233** MELTING POINT AND DECOMPOSITION PRESSURE OF NEPTUNIUM MONONITRIDE. Olson, W. M.; Mulford, R. N. R. (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem., 70: 2932-4(Sept. 1966). (LA-DC–7783).

Decomposition pressures for the reaction $NpN(s) = Np(l) + 0.5N_2(g)$ at 2210 to 2830°C are presented. NpN melts congruently at 2830 ± 30°C under a nitrogen pressure of about 10 atm. An equation, $\log p\ (atm) = 8.193 - [(29.54 \times 10^3)/T] + 7.87 \times 10^{-18}T^5$, was found to describe the decomposition pressure–temperature relation for NpN. A lattice parameter of a = 4.8987 ± 0.0005 Å was measured for the cubic nitride. (auth)

**43234** LANTHANUM–LANTHANUM HYDRIDE PHASE SYSTEM. Peterson, D. T.; Straatmann, J. A. (Ames Lab., Ames, Iowa). J. Phys. Chem., 70: 2980-4(Sept. 1966). (IS–1339).

Phase relations between lanthanum and lanthanum hydride were determined. Addition of hydrogen increased the melting point and decreased the fcc-to-bcc transformation temperature of lanthanum to a eutectoid at 773°C and 23.5 at. % hydrogen. Solubility of lanthanum hydride in fcc lanthanum ranged from 2.83 at. % at 375°C to 21.3 at. % hydrogen at 773°C. The enthalpy of solution was calculated to be 5.76 ± 0.17 kcal. Above 773°C the solubility of lanthanum hydride in bcc lanthanum increased rapidly, and complete solubility occurred at temperatures above 960°C. Hydrogen depressed the low-temperature transformation in lanthanum by 27°C. (auth)

**43235** THE FIRST IONIZATION POTENTIALS OF SAMARIUM, EUROPIUM, GADOLINIUM, DYSPROSIUM, HOLMIUM, ERBIUM, THULIUM, AND YTTERBIUM BY THE ELECTRON-IMPACT METHOD. Zmbov, K. F.; Margrave, J. L. (Rice Univ., Houston, Tex.). Contract AT(40-1)-2907. J. Phys. Chem., 70: 3014-17(Sept. 1966). (ORO–2907-2).

Ionization potentials of Sm, Eu, Gd, Dy, Ho, Er, Tm, and Yb atoms were measured by the electron-impact method using a magnetic mass spectrometer. Results are compared with optical spectroscopy and surface ionization methods with excellent agreement. (P.C.S.)

**43236** KINETICS OF ISOTOPE EXCHANGE BETWEEN GASEOUS HYDROGEN AND HYDROGEN DISSOLVED IN PALLADIUM. Andreev, B. M.; Boreskov, G. K.; Cheng Ch'ang Ch'un; Tsionskii, V. M. (Mendeleev Inst. of Chemistry and Tech., Moscow). Kinet. Kataliz, 7: 470-4(May–June 1966). (In Russian).

Temperature and pressure effects on the rate of isotopic exchange and separation of gasous hydrogen-deuterium system ($H_2$, $H_2 + HD + D_2$, and $D_2$) diffused in palladium were studied. The heat of isotopic exchange at −20 to 100°C was 1080 cal/mole and the activation energy was 7270 cal/mole. The isotopic-exchange-rate factor increased linearly with increases in hydrogen pressure over palladium. A strong dependence of the separation coefficient on hydrogen pressure was observed at pressure below 200 mm Hg. (R.V.J.)

**43237** SEMI-EMPIRICAL MOLECULAR ORBITAL ENERGY LEVELS OF $XeF_4$. Yeranos, Walter A. (Northern Illinois Univ., DeKalb). Mol. Phys., 11: 85-92(1966).

Using recently published analytical SCF wave functions for xenon, the one-electron molecular orbital energies of xenon tetrafluoride were re-determined in the Wolfsberg-Helmholz semi-empirical approximation. Unlike similar previous investigations, the study takes into consideration ligand–ligand overlap, and uses the recently proposed reciprocal mean for the semi-empirical evaluation of the resonance integrals. The results coincide with observed electronic transitions in the far uv spectrum of $XeF_4$. (auth)

**43238** INTERACTION OF CALCIUM, BARIUM, AND LANTHANUM IONS WITH BUILT-UP FILMS OF STEARIC ACID AND STEARATES. Fujita, Hitoshi (National Inst. of Radiological Sciences, Chiba, Japan); Otani, Sadaichi;

Mizuseki, Hideo; Miura, Masaji. Nippon Kagaku Zasshi, 87: 829-32(Aug. 1966). (In Japanese).

Monolayers of stearic acid-stearate on the aqueous substrate containing $Ca^{2+}$ or $Ba^{2+}$ were built-up on silicone-coated glass plates in the order of A- and B-film. The built-up film of stearic acid-stearate (2-layers) was immersed in an aqueous solution containing $^{45}Ca$ or $^{140}Ba-^{140}La$. After a given reaction time, the specimen was withdrawn from the radioactive solution and its radioactivity was measured by a G-M counter under a given geometry. The reaction seemed to involve two processes, i.e., salt-formation between stearate and metallic ions, and the isotope exchange of metallic atoms between the soap and the aqueous solution. The reactions of built-up films with $Ca^{2+}$ and $Ba^{2+}$ were dependent on the pH of the aqueous substrate for build-up and the aqueous solution for immersion. Above pH 9, Ca seemed to be adsorbed on the monolayers as colloidal particles. La behaved not as ion, but as colloidal particles or radiocolloid in the pH range higher than 5 to 6. (auth)

**43239** COEFFICIENTS OF TRACER TRANSFER THROUGH MEMBRANES. I. Plonka, Andrzej (Technical Univ. of Lodz, Poland). Nukleonika, 11: 319-25 (1966).

The relation between the coefficient of diffusion and coefficient of self-diffusion of sodium ions through cellophane membrane was verified experimentally. The former did not converge the latter as concentration of the solution decreased. (auth)

**43240** ON THE VIBRATIONAL STRUCTURE OF THE GROUND AND EXCITED LEVELS OF $UO_2^{2+}$ IN $K_4[UO_2(CO_3)_3]$. Gorbenko-Germanov, D. S.; Zenkova, R. A. Opt. Spectros. (USSR)(Engl. Transl.), 20: 467-9 (May 1966).

Tranlsated from Opt. Spektros., 20: 842-7(May 1966).

The absorption (4000 to 4600 Å) and luminescence (4700 to 5700 Å) spectra of crystalline $K_4[UO_2(CO_3)_3]$ at 77°K were investigated. A procedure for preparing samples for the taking of absorption spectra is described. An interpretation of the constant differences in the luminescence spectrum of $K_4[UO_2(CO_3)_3]$ is given and is compared with data on the ir spectra. A tentative interpretation of the constant differences in the absorption spectrum of $K_4[UO_2(CO_3)_3]$ is presented. A regular lowering of the symmetric and antisymmetric vibration frequencies ($\nu_1$ and $\nu_3$) of the uranyl group on going from the ground to the excited state is demonstrated; this indicates a compression of the vibrational sublevels in the excited level of $UO_2^{2+}$. It is shown that the ratio $\nu_3/\nu_1$ for $UO_2^{2+}$ (ground level) remains constant (1.09) in a number of different compounds. The ratio $\nu_3'/\nu_1'$ (excited level) in $K_4[UO_2(CO_3)_3]$ has a value (1.13) close to that of $\nu_3/\nu_1$. The ratio $\nu_1/\nu_1'$ also remains constant (1.20) in a number of uranyl compounds which were studied. (auth)

**43241** COVALENCY IN THE RARE-EARTH TRICHLORIDES. Newman, D. J.; Ellis, M. M. (Queen Mary Coll., London). Phys. Lett., 23: 46-7(Oct. 3, 1966).

On the basis that the zero field splitting of $Gd^{3+}: LaCl_3$ is due to spin-orbit induced covalency, it is shown that the covalency contribution to the crystal field in rare earth trichlorides is about 5%. (auth)

**43242** $Cr^{3+}$ AND RARE EARTH DOPED $LiNbO_3$. Burns, G.; O'Kane, D. F.; Title, R. S. (IBM Watson Research Center, Yorktown Heights, N. Y.). Contract DA-31-124-ARO-D-205. Phys. Lett., 23: 56-7(Oct. 3, 1966).

It was found that $LiNbO_3$ can readily be doped with rare earths and transition metal ions. The fluorescence is efficient and sharp. Results for $Cr^{3+}$ and $Nd^{3+}$ are discussed. (auth)

**43243** URANYL CHLORIDE COMPLEXES OF PYRAZINE AND SUBSTITUTED PYRAZINES. Balakrishnan, P. V.; Kamath, S. D.; Venkatasetty, H. V. (Atomic Energy Establishment, Trombay, India). pp 72-7 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Uranyl complexes with pyrazine, 2-methylpyrazine, 2,5-methylpyrazine, and 2,6-methylpyrazine were studied to determine the donor capacities of the two N atoms toward heavy metals and the effects of methyl substitution on the donor capacity. All the complexes were yellow solids with limited solubility in the usual solvents. Data are presented in tabular form for uv absorption maxima, prominent ir absorption bands, molar conductance, and molar magnetic susceptibilities for the compounds. Analysis of the data showed the substituted pyrazine complexes to be monomeric and that the uranium atom has six coordination numbers with octahedral configuration; in the pyrazine complex both nitrogens take part in bonding to the metal atom indicating a dimer configuration in which the uranium atom exhibits seven coordination numbers. Conductance data of nitromethane solutions of the complexes revealed that all were nonelectrolytes and weakly diamagnetic. (P.C.S.)

**43244** STUDY OF Pu(III)–SULPHATE COMPLEXES. Nair, G. M.; Rao, C. L.; Welch, G. A. (Atomic Energy Establishment, Trombay, India). pp 78-83 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The nature and stability of the complex species formed by Pu(III) with sulfate ions were studied using the cation exchange method. A solution of 0.10M was determined to be the best agent for reducing plutonium to the trivalent state. The $SO_4^-$ concentration in the solutions ($H_2SO_4$, $HSO_4^-$, and $SO_4^{2-}$) was calculated using the second acid dissociation constant (0.302) for $H_2SO_4$. No complex higher than the second order was found from graphical analysis. Formation of any anionic species in the medium was ruled out by anion exchange experiments and electrical migration experiments. Analysis by least squares technique showed formation of only two complex species, $Pu(SO_4)_2^+$ and $Pu(HSO_4)_2^+$, with stability constants estimated at $K_1 = 18.13 \pm 0.44$ and $K_2 = 9.94 \pm 0.24$. The stability constant of $Pu(SO_4)^+$ agreed with that reported earlier for $AmSO_4$ but was much higher than that for $PuCl^{2+}$ and $PuNO_3^{2+}$, indicating a complexing-ability pattern of $Cl^- < NO_3^- < SO_4^{2-}$. Data are included for the distribution coefficients of Pu(III) with and without complexing agent. (P.C.S.)

**43245** KINETICS OF THE REDUCTION OF TETRAVALENT PLUTONIUM BY HYDROGEN PEROXIDE IN PERCHLORIC ACID SOLUTIONS. Mazumdar, A. S. Ghosh; Vaidyanathan, S. (Atomic Energy Establishment, Trombay, India). pp 84-91 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Decomposition of the brown peroxy complex that formed when dilute $H_2O_2$ was added to the pink-colored Pu(IV) solution in perchloric acid was studied. The composition of this complex was derived from equilibrium constant measurements and was concluded to be the same as that in dilute HCl. The rate of reduction of Pu(IV) to Pu(III) was dependent on the rate of decomposition of the intermediate peroxy complex. (P.C.S.)

**43246** THE KINETICS OF EXCHANGE REACTIONS: A REVIEW OF RECENT DEVELOPMENTS. Anantakrishnan, Sekharipuram V. (Madras Christian Coll.). pp 250-4 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

**43247** ISOTOPIC EXCHANGE OF BROMINE BETWEEN ACETYL BROMIDE AND SOME LABELLED BROMIDES. Desai, K. K.; Haldar, B. C. (Inst. of Science, Bombay). pp 255-61 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The isotopic exchange of bromine between acetyl bromide and tetra-substituted ammonium bromides labeled with $^{82}Br$ was studied. It was found that the exchange of bromine between acetyl bromide and benzyldimethylphenylammonium bromide is complete within the time of separation. Results with tetraethylammonium bromide are similar. (P.C.S.)

**43248** THE ISOTOPE EXCHANGE REACTION BETWEEN IODIDE AND IODATE IONS STUDIED BY PAPER

CHROMATOGRAPHY. PART II. Arnikar, H. J.; Dedgaonkar, V. G. (Univ. of Poona). pp 262-73 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Exchange reactions were studied with an improved technique over a wide range of reactant concentrations, temperature, pH of the medium, and the influence of added iodine, $Cl^-$, $NO_3^-$, and $SO_4^{2-}$ on the rate constants. The period of induction was on the order of 0.5 to 5 hr, increased with decreased reactant concentrations, and diminished with rise of temperature and increase of pH above 7. Temperature ranged from 185 to 300°C. (P.C.S.)

**43249** A TRACER STUDY OF THE LIESEGANG RINGS. PART III. Arnikar, H. J.; Sahakari, M. P.; Sidhaye, Leela (Univ. of Poona). pp 310-18 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Formation of Liesegang rings in the precipitation of the phosphates of Ca, Fe(II), and Co was studied employing $^{45}Ca$, $^{59}Fe$, $^{60}Co$, and $^{32}P$ to label the systems. Data obtained by double-labeling techniques showed a periodicity in the concentration distribution of the reacting ions. Results indicated that a difference in diffusion rates of the reacting ions, $Ca^{2+}$ and $PO_4^{3-}$, which makes the precipitate selectively permeable to the faster ion, favored periodic precipitations. (P.C.S.)

**43250** STUDIES ON DESORPTION OF TRACER IODIDE IONS ADSORBED ON SILVER. Arnikar, H. J.; Daniels, E. A. (Univ. of Poona). pp 319-26 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The desorption of tracer iodide ions adsorbed on silver was studied in terms of desorbability from mono- and multi-layers (1 to 100) of absorbate at higher temperatures, 300 to 400°C. Three sets of studies were made in regard to the furnace atmosphere: air at atmospheric pressure, argon flowing at a pressure 810 mm, and near vacuum (air pressure $< 2$ mm). In all cases studied, the rate of desorption followed first order kinetics, and the k value increased with temperature. Under desorption conditions silver iodide showed negative ionization under the action of an externally applied electric field. The observed energy of activation (32.3 k cal mole) for desorption under near vacuum conditions was of the same order of magnitude as the latent heat of evaporation of AgI (34.45 k cal/mole), indicating desorption was relatively faster in mono- than in deeper-lying multilayers. (P.C.S.)

**43251** STUDIES ON THE ADSORPTION OF TRACERS ON GLASS. Arnikar, H. J.; Joshi, S. B. (Univ. of Ponna). pp 327-36 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Time-rates of sorption by glass were studied using $^{131}I$, $^{45}Ca$, $^{90}Sr$, and $^{131}Ba$. Results showed characteristic differences in the sorption of iodide ions from those of the alkaline earth cations. The iodide sorption proceeded in a smooth continuous manner and reached saturation in about 24 hr. Sorption of the cations proceeded in a discontinuous fashion without reaching saturation. Computation showed that the mono-layer of sorption can be easily distinguished. No measurable desorption of the adsorbed Ca, Sr, or Ba on glass was observed on heating the sample to high temperatures (~400°C) even after 12 hr; whereas the iodide layer was nearly wholly desorbed within 1 to 2 hr at this temperature. (P.C.S.)

**43252** ON THE STUDY OF TETRAHYDRATED DOUBLE SULPHATES OF TERVALENT ELEMENTS WITH RADIOACTIVE INDICATORS. Purkayastha, B. C.; Bhattacharyya, D. K. (Saha Inst. of Nuclear Physics, Calcutta). pp 349-55 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Distribution studies with $(NH_4)Ce(SO_4)_2 \cdot 4H_2O$ and $(NH_4)Tl(SO_4)_2 \cdot 4H_2O$ as hosts and radioisotopes such as $^{46}Sc$, $^{91}Y$, $^{55}Fe$, $^{59}Fe$, $^{210}Bi$, $^{114}In$, $^{152}Eu$, $^{154}Eu$, $^{160}Tb$, and $^{170}Tm$ were undertaken. From a series of studies, it was concluded that all tervalent cations form tetrahydrated double sulfates, and that there are two groups with the same crystalline form but different parameters. Tetrahydrated double sulfates of yttrium, bismuth, and rare earths are on one side and those of scandium, indium, thullium(III), iron(III), and aluminum belong to the other. (P.C.S.)

**43253** A NEW CLASS OF HETEROPOLY COMPOUNDS OF OCTATUNGSTOCERATES(IV). II. Ripan, Raluca; Todorut, Ioan (Institut de Chimie de l'Academie, Cluj). Rev. Roum. Chim., 11: 691-6(June 1966). (In French).

Five salts of a heteropoly anion $(Ce^{IV}W_8O_{28})^{4-}$, which contains tetravalent cerium and tungstic anhydride, were prepared. Their general formula, determined by chemical analysis and thermogravimetry, is $Me^I_4(Ce^{IV}W_8O_{28}) \cdot xH_2O$, where $Me^I$ is $Na^+$, $NH_4^+$, $K^+$, $Rb^+$, and $Cs^+$. Some of the physicochemical properties of these salts were studied, and compared with the properties of the salts of $Na^+$, $NH_4^+$, $K^+$, $Rb^+$, and $Cs^+$ with the heteropoly anion $(Ce^{III}W_8O_{28})^{5-}$, in which cerium is trivalent. It was shown that there is a possibility of using them for analytical purposes. (tr-auth)

**43254** THE DETERMINATION OF OPTICAL PURITY BY NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. II. COMPOUNDS WHICH OWE THEIR DISSYMMETRY TO DEUTERIUM SUBSTITUTION. Raban, Morton; Mislow, Kurt (Princeton Univ., N. J.). Tetrahedron Lett., No. 33, 3961-6(Aug. 1966).

The nuclear magnetic resonance (NMR) method was used to determine the optical purities of (S)-propan-2-ol-1-$d_3$ (I) and (S)-2,2-dimethylpropan-1-ol-1-d (II). The methyl groups are magnetically equivalent in the chemical shift sense. When isopropyl alcohol is esterified with a chiral reagent, two methyl groups reside in diastereomeric environments, i.e., they are diastereomeric by internal comparison. Such methyl hydrogens must, in principle, be magnetically nonequivalent in the chemical shift sense, and in many cases the nonequivalence is large enough to be observed. The two diastereomeric methyl groups in isopropyl O-methylmandelate give rise to two doublets ($J_a = 6.2$ cps, $J_a = 6.3$ cps), which are chemically shifted by 0.085 ppm. The two diastereomeric methyl groups in the two epimeric esters must show an analogous chemical shift. The NMR of the ester was identical with that of the undeuterated material except that the isopropyl methine signal occurred as a broadened quartet rather than as a multiplet, and that the doublet corresponding to the low-field methyl group was absent. Increased spectrum amplitude scans indicated that less than 1% of the other diastereomer could be present, and the optical purity of the sample was 99 ± 1%. A sample of II, formed by fermentation of trimethylacetaldehyde-1-d by actively growing yeast, and containing 82 ± 3% g-equivalents deuterium, was reacted with an excess of an optically pure chiral reagent. The NMR spectrum showed the optical purity of the II to be 99 ± 1%. Thus, II obtained by fermentation is essentially optically pure. The results provide a foundation for the method for determining optical purities of $\alpha$-deuterated primary alcohols based on partial resolution. (BBB)

**43255** ISOTOPIC MIXING IN HYDROGEN CHEMISORBED ON POLYCRYSTALLINE TUNGSTEN. Ricca, F.; Medana, R.; Saini, G. (Univ., Turin). Trans. Faraday Soc., 62: 2273-9(Aug. 1966).

Isotopic mixing of hydrogen and deuterium on a tungsten sheet was studied through desorption spectra, in an uhv system, by employing an omegatron with lanthanum hexaboride cathode. The three fundamental forms of chemisorption $\alpha$, $\beta$, and $\gamma$ were studied by desorption spectra of mixtures of $H_2$ and $D_2$ chemisorbed at 77, 198, 298, and 473°K. No isotopic mixing occurred in $\gamma$ hydrogen, while a large conversion of $H_2$ and $D_2$ to HD was found in both $\alpha$ and $\beta$ forms. Exchange between $\alpha$ and $\beta$, as well as between $\beta_1$ and $\beta_2$ forms was also found. (auth)

**43256** EXTRACTION OF RARE-EARTH ANTIPYRINE-SALICYLATE COMPLEXES BY BENZENE AND FLUOROMETRIC DETERMINATION OF TERBIUM. Tushchenko, M. A.; Poluektov, N. S. (Inst. of General and Inorganic

Chemistry, Odessa). Ukr. Khim. Zh., 32: 733-8(1966). (In Russian).

Conditions for the benzene extraction of antipyrine-salicylate complexes of the rare earth elements were investigated. By means of the isomolar series method, it was established that 1.5 molecules of antipyrine were necessary for the extraction of one atom of the metal. Ternary complexes of the rare earths Y, La, Nd, Sm, Tb, and Er were prepared and their rare earth and antipyrine contents were determined. It was established that the general formula has the form $[Me_2(C_{11}H_{12}ON_2)_3] \cdot [C_6H_4(OH)COO]$. The ternary complexes of Tb display a bright fluorescence in benzene solutions during irradiation with long-wave ultraviolet light. A method for the determination of Tb in rare earth oxide mixtures was developed with a sensitivity of 0.1–0.001% $Tb_4O_7$ in dependence on the type of element matrix. (tr-auth)

**43257** $WO_3$: ITS GROWTH AND CRYSTALLOGRAPHIC INVESTIGATIONS. Kleber, W.; Haehnert, M.; Mueller, R. (Humboldt-Univ., Berlin). Z. Anorg. Allg. Chem., 346: 113-26(Aug. 1966). (In German).

By means of chemical transport reactions (with HCl, $Cl_2$, or $CCl_4$ at 650 to 1110°C) and by crystal growth from molten solutions ($WO_3-Na_3AlF_6$, $-NaPO_3$, $-Li_2MoO_4$), $WO_3$ single crystals were prepared and characterized by suitable methods. With the transport method, well-ordered single crystals of good morphological qualities were obtained. (auth)

**43258** ELECTRON-RICH COMPLEXES OF YTTRIUM WITH 2,2'-DIPYRIDYL. Herzog, S.; Gustav, K. (Ernst-Moritz-Arndt-Univ., Greifswald, Ger.). Z. Anorg. Allg. Chem., 346: 150-61(Aug. 1966). (In German).

The preparation of several yttrium 2,2'-dipyridyl compounds is described. Their magnetic moments at room temperature, behavior in vacuo and solvents are communicated and discussed. (auth)

**43259** ELECTRON-RICH COMPLEXES OF LANTHANUM WITH 2,2'-DIPYRIDYL: $LaDipy_4$. Herzog, S.; Gustav, K. (Ernst-Moritz-Arndt-Univ., Greifswald, Ger.). Z. Anorg. Allg. Chem., 346: 162-5(Aug. 1966). (In German).

The preparation of dipyridyl lanthanum complexes and their properties (sensitivity to air; behavior in vacuo and solvents; magnetic moments; and nonelectrolyte character) are described. (auth)

**43260** FORMATION OF SCANDIUM OXIDE CHLORIDE PHASES. Petru, F.; Koslerova, J.; Hajek, B. (Institut fuer Anorganische Chemie, Prague). Z. Chem., 6: 229-30 (June 1966). (In German).

A solution of pure $Sc_2O_3$ in dilute HCl was heated to dryness in a porcelain shell; this preparation, containing 35.47% Sc, was divided into portions and heated in separate shells at different temperatures to constant weight. None of the samples prepared at temperatures between 150 and 380°C for 4.5 hours or longer gave an analysis for ScOCl. Debyeograms of each sample were recorded and are illustrated. The preliminary results indicate that the conditions described give rise to Cl-containing products that differ in their composition and structure and finally at high temperatures are converted into $Sc_2O_3$, but none of these approximate the supposed oxychloride reported by others from the thermal decomposition of $ScCl_3$ hydrate. (BBB)

**43261** STANDARD HEAT OF FORMATION OF NIOBIUM CARBIDES IN NbC PHASE. Kornilov, A. N.; Zaikin, I. D.; Skuratov, S. M.; Shveikin, G. P. (Moscow State Univ. Inst. of Chemistry, Academy of Sciences, USSR). Zh. Fiz. Khim., 40: 1070-6(May 1966). (In Russian).

The standard heats of formation of other niobium carbides from the NbC phase were determined as a function of the composition. It is shown within the error of the experiment, that the equation for the heat of formation is linear and is described as follows: $-\Delta H_{form.}\ NbC_x = 18.9 + 14.00x$ (in kcal/g mole). (R.V.J.)

**43262** LUMINESCENCE SPECTRA OF ORGANIC SOLUTIONS OF URANYL SALTS AT DIFFERENT STAGES OF DAMPING. Volodko, L. V.; Turetskaya, E. A. Zh. Prikl. Spektrosk., Akad. Nauk BSSR, 3: 248-53(Sept. 1965). (In Russian).

Damping curves and luminescence spectra were investigated for various stages of de-excitation of organic solutions of uranyl nitrate and uranyl acetate at 77°K. In each solution three luminescence centers were discovered having different emission spectra and durations of the excited state, two of which belong to different uranyl complexes. (auth)

**43263** CONTRIBUTIONS TO THE CHEMISTRY OF LOWER U SULFIDES. Schaper, P. Brunswick, Technical Univ., 1965. 61p. $2.00 Gmelin, AED-Diss. 65-374.

Thesis.

Methods for preparing $U_2S_3$ and US are given. Lattice parameters were determined by roentgenography. The chemical properties of the sulfides are nearly identical. (Gmelin Inst.)

**43264** SUL'FIDY REDKOZEMEL'NYKH METALLOV I AKTINOIDOV. (Sulfides of Rare Earth Metals and Actinides). Radzikovskaya, S. V.; Marchenko, V. I. Kiev, Naukova Dumka, 1966. 140p.

Descriptions are given of the structure and physico-chemical properties of sulfides of rare earth metals and actinides. Chemical analysis and the method for preparing rare earth and actinide sulfides are discussed and applications of high-melting sulfides in technology are analyzed. (R.V.J.)

**43265** ELEKTRONNYE I IONNYE PROTSESSY V TVERDYKH TELAKH. I. (Electron and Ion Processes in Solids. I.). Tbilisi, Georgian SSR, Izdatel'stvo Metsniereba, 1964. 112p.

A study of electrons and ion processes in solids is presented. Topics covered are: influence of nuclear irradiation on properties of alkali-halide crystals; influence of defects of the structure on mechanical properties in crystals; radiation effects on dislocation densities in ionic crystals; local centers in irradiated ionic crystals; quantum theory of cyclotron resonance in degenerated zone; cyclotron and combined resonances in crossed fields in semiconductors with the loop of extrema; the shape of the cyclotron resonance line and magnetic-optical absorption in a germanium crystal; change of magnetic spectrum caused by S-d interaction in ferrometals; magnetic inelastic scattering of neutrons from a ferromagnetic crystal; destruction of thin film superconductivity by current pulses; ionic etching of sodium chloride crystals; measurements of big optical densities; cryostat for the spectrophotometer SF-4; and obtaining cobalt with the desired properties and study of these properties by the method of neutron polarization. Separate abstracts were prepared for 5 papers; one paper was previously published in NSA and appeared as 19: 3347. (D.H.M.)

*For abstracts of individual papers see: 43303–43306 and 44511.*

**43266** METHOD FOR THE ELECTROLYTIC PRODUCTION OF URANIUM DIOXIDE CRYSTALS. Verkerk, Barend; Schlechte, Michiel; Houtman, Johannes Paulus Willem (to Reactor Centrum Nederland). German Patent 1,216,274. May 12, 1966. Priority date Aug. 4, 1961, Netherlands.

$UO_3$ is reacted in a molten salt mixture ($LiCl-KCl$ or $NaCl-KCl-MgCl_2$) with HCl gas to obtain $UO_2Cl_2$ and the reaction product is electrolyzed successively at a temperature between 500 and 600°C. (auth)

**43267** ADVANCES IN X-RAY ANALYSIS. VOLUME 9. Proceedings of the Fourteenth Annual Conference on Applications of X-Ray Analysis, Held August 25–27, 1965. Mallett, Gavin R.; Fay, Marie; Mueller, William M. (eds.). Advances X-Ray Anal., 9: 1-544(1966). (CONF-650810).

Forty-six papers presented at the Fourteenth Annual Conference on the Applications of X-Ray Analysis are given.

instruments such as a stereo topographical camera, a dual-counter analyzer for rapid quantitative analysis, high-intensity rotating anode tubes, a combined diffractometer and spectrometer, and a two-crystal spectrometer attachment for x-ray use are discussed and many new techniques are explained. (P.C.S.)

**43268** MECHANISM OF THE SELF-INDUCED ISOTOPIC EXCHANGE OF TRITIUM WITH TOLUENE. Ache, Hans J. (Virginia Polytechnic Inst., Blacksburg). 8p. (CONF-660320-6). ORAU. Gmelin, AED-CONF-66-051-12.

From American Chemical Society, 151st Meeting, Pittsburgh.

Studies of some of the parameters that determine the isotopic exchange rate between tritium and toluene in the gas phase under the influence of tritium's $\beta$ decay are discussed. The L-value (number of tritium atoms incorporated into the toluene per tritium $\beta$ decay) was found to be a function of the tritium used and increased from a value of L-0.71 with the use of 50mC to L = 5.5 for 500 mC of tritium. Two reaction paths leading to the labeling of the toluene are proposed to explain the different L values: the $\beta$ decay-induced mechanism along the $(^3HeT)^+$ and a mechanism that is initiated by tritium $\beta$ radiolysis and in which ionized or excited species and radicals might be responsible for the labeling process. At low tritium gas concentrations ($\leq$50 mC), the first reaction is considered to be solely responsible for tritium incorporation into the aromatic ring, and the reaction is unaffected by oxygen or rare gases. At higher tritium concentrations in the gas phase ($\geq$500 mC), the labeling process occurs mainly by the second reaction and is greatly affected by oxygen or rare gases. For mixtures of benzene and toluene containing 500 mC of tritium, the tritium-labeling of one component is unaffected by the presence of the other and is simply a function of the electro fraction. (B.L.M.)

**43269** CONTRIBUTION TO THE THERMOCHEMISTRY OF BERYLLIUM FLUORIDE: A NEW APPLICATION OF THE ROTATING-BOMB CALORIMETER. Armstrong, George T.; Coyle, Charles F. (National Bureau of Standards, Washington, D. C.). 35p. (CONF-651142-1). ORAU. Gmelin, AED-CONF-65-358-1.

From American Chemical Society, Western Regional Meeting, Los Angeles.

The rotating bomb calorimeter was applied to experiments to determine the heat of formation of $BeF_2$. Beryllium metal was dissolved directly in HF; however, certain modifications of the usual calorimeter and the manner in which it was used were necessary. These modifications are described in detail, as is the entire experimental procedure. The data obtained experimentally were inadequate to allow a firm statement to be made about the heat of formation of $BeF_2$. However, adjustment of reported values for the heat of solution of $BeF_2$ in aqueous HF in more concentrated solutions was made, a series of possible reactions were devised that could be carried out or data obtained from the literature to make possible the adjustment from one concentration to the other, and additional reactions were developed from which the data could be used to calculate the heat of formation. All these reactions are listed in tabular form. Values were obtained for $\Delta H$, and a value for the heat of formation was finally calculated as −242.38 Kcal/mole. It was concluded that the true heat of formation probably does not differ from this value by more than a few Kcal/mole. (B.L.M.)

## Organic Chemistry

*Refer also to abstract 44126.*

**43270** (AEET-245) APPARATUS FOR THE THERMAL CONDUCTIVITY DETERMINATION OF SOME ORGANIC COOLANTS USED IN NUCLEAR REACTORS. Natarajan, K.; Ramani, M. P. S.; Vartak, D. G. (Atomic Energy Establishment, Trombay (India)). 1966. 26p. Dep. mn.

A suitable apparatus for measuring thermal conductivity of organic liquids used in nuclear reactors is described. The apparatus was first used to determine the thermal conductivity of water and nitrobenzene. Then the thermal conductivity of reactor coolants such as Dowtherm, Santowax O.M., monoisopropyl biphenyl, o-terphenyl, m-terphenyl, p-terphenyl and Santowax-R were determined and values compared with those available in the literature. (P.C.H.)

**43271** (IAE-1066) ANALIZ ISPYTANII USTANOVKI DESTRUKTIVNO-GIDROGENIZATSIONNOI REGENERATSII GAZOILEVOGO TEPLONOSITELYA AES "ARBUS". (The Test Analysis of a Device for the Hydrogenation Regeneration of Decomposed Gas-Oil Coolant in AES "Arbus"). Aleksenko, Yu. N.; Brodskii, A. M.; Zabelin, A. I.; Kevrolev, V. P.; Lavrovskii, K. P.; Makarov, D. V.; Tetyukov, V. D.; Fish, Yu. L.; Chikova, N. P. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). 1966. 24p. Dep. mn.

The results of the experimental operation of the regeneration unit of the Atomic Electrical Station "Arbus-I" and of numerous laboratory investigations are presented. It was found that the hydrogenation regeneration of decomposed organic coolants reduces substantially the radiolytic losses of carriers. The optimal temperature in the reaction devices was found to be 360°C, hydrogen pressure − 40 to 50 atm, volumetric rate of regenerated product − 0.3 to 0.5/hour, and the molar ratio of hydrogen and the regenerated product − 6 : 1. Numerous other recommendations are also given. (P.C.H.)

**43272** (RLO-581-10, pp 5-32) BIOPHYSICS SECTION. (Oregon Univ., Portland. Div. of Experimental Medicine).

Progress is reported on studies on the chemical composition, molecular biophysical constants, and hemagglutinating and mitogenic activity of protein phytohemagglutinin. Studies on the mitogenicity of various fractions of crude bean extract (Phaseolus vulgaris) indicated that more than one mitogenic and hemagglutinating substances exist in Phaseolus vulgaris. Assays of the mucoprotein and polysaccharide components of phytohemagglutinin indicated that the polysaccharide inhibits both the mitogenic and hemagglutinating activities but the mitogenic activity to a greater extent. The factors influencing the effect of phytohemagglutinin on cultured normal blood lymphocytes were studied. A triple tracer method, using $^3H$−uridine, $^{14}C$−thymidine, and $^{75}Se$−selenomethionine as tracers, was used to study the effects of protein phytohemagglutinin on the synthesis of RNA, DNA, and protein. Data are also included from immunological studies in adult and newborn rabbits immunized with protein phytohemagglutinin and the effect of protein phytohemagglutinin on cultured mouse lymphoma cells. Studies of human hemoglobins included the characterization of an abnormal fetal hemoglobin, studies on the oxygen affinity of hemoglobin H, and the oxygen affinity of hemoglobin of old and young erythrocytes. (C.H.)

**43273** SYNTHESIS OF 4-ASPARTAL-1 AND 2-$^{14}C$. Municio, A. M.; Vega, A. (Instituto de Quimica, Madrid). An. Real Soc. Espan. Fis. Quim. (Madrid), Ser. B, 62: 769-73(June 1966). (In Spanish).

The synthesis of aspartic acid semialdehyde 1- and 2-$^{14}C$-labeled was carried out using $Na^{14}CN$ and ethyl malonate-2-$^{14}C$. Purification methods are described that make aspartic acid semialdehyde useful as substrate in experiments of biosynthesis. (auth)

**43274** LABELING OF PROTEINS WITH $^{131}I$ USING CHLORAMINE T. Bocci, Velio (Univ., Siena, Italy). Atti Accad. Fisiocrit. Siena Sez. Med.-Fis., 12: 1845-55 (1963).

Optimal conditions for radioiodinating proteins using chloramine T as an oxidizing agent were investigated, and a new method which was developed is described. This method results in a higher labeling efficiency, although much less iodine appears bound to a given weight of protein in comparison with previously published methods. The results of studies on the radioiodination of rat and rabbit tissue—soluble proteins are reported. The final procedure adopted was as follows: to a solution (1.0 ml) of soluble proteins (14 to 30 mg) was added 0.15M phosphate buffer (pH 7.6) containing required amount (0.025 to 0.5 mC) of carrier-free $^{131}$I and then chloramine T solution (10.0 mg/ml in pH 7.6 phosphate buffer). The test tube was stoppered with Parafilm, gently shaken, and, to increase labeling efficiency, oxidation was allowed to proceed for 60 min. At this stage the protein solution was diluted 3.5 times, and sodium metabisulfite solution (6.25 mg/ml, w/v, in pH 7.6 phosphate buffer) and carrier sodium iodide (0.2 ml of a 10% solution) were added separately with mixing. About 0.50 mg of freshly prepared sodium metabisulfite was sufficient to prevent any iodination due to 1.0 mg of chloramine T. The reducing agent was a slight excess in order to avoid overiodination or adding carrier iodide. The reaction mixture, after having been counted to determine the total radioactivity, was passed through a column (8.0 × 1.0 cm) of the anion-exchange resin De Acidite FF in the chloride form. The eluates, including two 0.15M sodium chloride washings, were counted for recovery of radioactivity. To attain higher recoveries the exchange resin columns were presaturated with 5–10 mg of soluble proteins. The data were obtained by labeling with $^{131}$I, using increasing amounts of chloramine T, rabbit serum and soluble proteins from lung and brain as well as from rat serum and liver. Results were reproducible. Labeling efficiencies were lower for rabbit lung and brain soluble proteins compared with those for serum proteins. Dialysis of soluble tissue proteins was useful because it increased labeling efficiencies. No binding of $^{131}$I to proteins was observed if chloramine T was omitted. Autoradiograms showed that radioactivity was firmly bound to serum and tissue proteins after electrophoretic separation on starch gel. (BBB)

**43275** CATALYTIC HYDROGEN EXCHANGE OF ANILINE ON SUPPORTED METAL CATALYSTS. Hagiwara, Hiroshi; Echigoya, Etsuro (Tokyo Inst. of Tech.). Bull. Chem. Soc. Jap., 39: 1683-9(Aug. 1966).

The hydrogen-exchange reaction of aniline with deuterium was investigated on nickel, cobalt, and platinum. At 150°C, the hydrogen of the amino group of aniline exchanged at a higher velocity than the hydrogen attached to the benzene ring. At temperatures as high as 300°C, the hydrogen exchange in the benzene ring increased further. The suggested hydrogenation mechanism obtained from results of the exchange reaction could not be correlated with that obtained from the kinetic study. Catalytic activity for the exchange reaction in the benzene ring was in the order Pt > Co > Ni. The basic oxide support seemed to suppress the adsorption of the amino group. The relation between the adsorption state of the aniline on the catalyst surface and the various reaction products, such as cyclohexylamine, benzene, and dicyclohexylamine, was well established. (auth)

**43276** THE OXYGEN EXCHANGE REACTION OF PHENOL IN ACIDIC MEDIA. Oae, Shigeru (Osaka City Univ.); Kiritani, Reiko; Tagaki, Waichiro. Bull. Chem. Soc. Jap., 39: 1961-7(Sept. 1966).

The acid-catalyzed oxygen exchange reaction of a number of phenolic compounds (phenol, o- m- and p-hydroxy phenols, α- and β-naphthols, o- m- and p-nitrophenols, o- m- and p-aminophenols, o- and p-bromophenols, 2,4,6-tribromophenol, o- m- and p-cresols, and 2,4,6-trimethylphenol) and quinone for comparison with $^{18}$O-enriched water was carried out under various conditions. A plot of the log $k_x/k_h$ line against Hammett σ-constants in the substituted phenols gave a fairly good correlation line ($\rho = 0.47$) except in the cases of p-bromophenol and p-aminophenol. The mechanism of these reactions is discussed. (auth)

**43277** SOME NEW DATA ON THE RADIOCHEMICAL POLYMERIZATION OF ACRYLONITRILE IN THE CRYSTALLIZED STATE. Chapiro, Adolphe; Inoue, Miyako (CNRS, Bellevue, France). Compt. Rend., Ser. C, 263: 46-8(July 4, 1966). (In French).

The radiochemical polymerization of pure acrylonitrile and acrylonitrile containing 5% acetone was studied between −95 and −196°C. A discontinuity appears at 140° in Arrhenius diagrams of conversion rates and molecular weights. The phase transition associated with it modifies the propagation but not the chain initiation. A new discontinuity appears near −180°. It is associated with the capture of electrons below this temperature. Acetone inhibits the polymerization at all temperatures and also plays the role of an electron interceptor. The results confirm that the radiochemical polymerization of crystallized acrylonitrile is propagated at least in part by an ionic mechanism. (tr-auth)

**43278** THE SECONDARY β-DEUTERIUM ISOTOPE EFFECT AND THE CAGE EFFECT IN THE THERMAL DECOMPOSITION OF AZOBIS-α-PHENYLETHANE. Seltzer, Stanley; Hamilton, Edwin J. Jr. (Brookhaven National Lab., Upton, N. Y.). J. Amer. Chem. Soc., 88: 3775-81(Aug. 20, 1966). (BNL-10099)

Azobis-α-phenylethane-β,β,β-$d_3$ was prepared and its rate of decomposition in ethylbenzene at 105°C was compared to that for the natural compound. Calculations indicate that approximately one-fourth of the rate retardation is due to the effect of increased mass on the ratio of imaginary frequencies. The residual β effect in the formation of the α-phenylethyl radical is about one-fourth as large as the comparable β effect in the formation of the α-phenylethyl carbonium ion and suggests that hyperconjugative stabilization in the radical is somewhat diminished in comparison with the ion. In addition the cage effect was measured in the absence of scavengers. (auth)

**43279** MECHANISM OF METAL-CATALYZED HYDROGENATION AND EXCHANGE. THE PHENYL EFFECT. Smith, Gerard V.; Roth, Jerome A. (Illinois Inst. of Tech., Chicago). J. Amer. Chem. Soc., 88: 3879-81(Aug. 20, 1966).

A phenyl substituent at the C–C double bond was found to increase the extent of pure 1, 2-cis addition relative to other processes such as exchange, racemization, double bond migration, and cis-trans isomerization. NMR and mass spectral studies of deuterium distributions acquired by substituted ethylenes and their reduction products during liquid phase deuteriogenation over 5% palladium on charcoal and 5% platinum on charcoal are reported. In every instance substitution of phenyl for hydrogen, methyl, or carbomethoxyl increased 1, 2-cis addition relative to exchange, i.e., deuterium distributions were more symmetrical and dideuterio species more prevalent. Recognition of the effect allowed correlation of a mass of seemingly contradictory and unrelated data and better understanding of surface species. (J.G.B.)

**43280** SOLVENT ISOTOPE EFFECTS IN AMIDE HYDROLYSIS. Schowen, Richard L.; Jayaraman, H.; Kershner, Larry; Zuorick, G. W. (Univ.of Kansas, Lawrence). J. Amer. Chem. Soc., 88: 4008-12(Sept. 5, 1966).

The rate of hydrolysis of 2,2,2-trifluoro-N-methylacetanilide (I) was determined as a function of lyoxide ion concentration in protium and deuterium oxide solutions at 25.00 ± 0.05°C. The kinetic law in both media was in agreement with a mechanism involving formation of an adduct of I and lyoxide ion, followed by its general base-catalyzed decomposition. The observed kinetic isotope effects are $k_a^{H_2O}/k_a^{D_2O} = 1.0 \pm 0.2$ (for addition), $k_1^{H_2O}/k_1^{D_2O} = 3.3 \pm 0.7$ (for solvent-catalyzed elimination), and $k_2^{H_2O}/k_2^{D_2O} = 2.2 \pm 0.3$ (for lyoxide ion catalyzed elimination). The secondary contributions to the latter two effects are estimated to be $(k_1^{H_2O}/k_2^{D_2O})_{sec} = 0.75$ and $(k_2^{H_2O}/k_2^{D_2O})_{sec} = 0.48$, leading to estimates for the primary contributions of $(k_1^{H_2O}/k_1^{D_2O})_{pri} = 4.4 \pm 1$ and $(k_2^{H_2O}/k_2^{D_2O})_{pri} = 4.6 \pm 1$. The rate-determining step appears to involve proton transfer; it is postulated that general base-catalyzed reactions are either (a) simple proton-transfer reactions or (b) "solvation rule" reactions, depending on the nature of the leaving group. (auth)

**43281** STRUCTURAL STUDIES OF RIBONUCLEASE. XXIV. THE APPLICATION OF NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY TO DISTINGUISH BETWEEN THE HISTIDINE RESIDUES OF RIBONUCLEASE. Bradbury, J. H.; Scheraga, Harold A. (Cornell Univ., Ithaca, N. Y.). J. Amer. Chem. Soc., 88: 4240-6(Sept. 20, 1966).

Proton magnetic resonance studies of L-histidine, glycyl-L-histidine, L-histidyl-glycine, and poly-L-histidine showed that deuteration of the imidazole group is accompanied by a downfield chemical shift of about 0.9 ppM of the C-2 proton and about 0.4 ppM of the C-4 proton. The former chemical shift is studied as a function of pD in $D_2O$ for DL-histidyl-DL-histidine, and approximate values of the microscopic dissociation constants for the two imidazole groups are determined. With ribonuclease, the C-2 proton resonance falls downfield from the aromatic resonance for all values of pD. Using a computer of average transients it is found that the resonance splits into three peaks at values of pD between 5.4 and 8. The two groups with average microscopic dissociation constants pk of approximately 5.4 and 5.8 have been tentatively assigned to the two histidines involved in the active site of the enzyme and the two groups with identical pk values of approximately 6.6 to the other two histidine residues. In oxidized ribonuclease the four histidine residues are normalized with pK′ ~ 7.4. (auth)

**43282** PROTON MAGNETIC RESONANCE SPECTRA OF SOME DI- AND TRI-AZANAPHTHALENES AND NITROISOQUINOLINES. **Armarego, W. L. F.; Batterham, T. J. (Australian National Univ., Canberra). J. Chem. Soc. (London), B, No. 8, 750-3(1966).**

The 4-deutero-derivatives of quinazoline and 1,3,5-triazanaphthalene were prepared and used to show that the signals at lowest field in the proton magnetic resonance spectra of the non-deuterated compounds are due to H-4. Proton magnetic resonance spectra of 5-, 7-, and 8-nitroisoquinoline, 3-nitro-1,5-, 3-nitro-1,6-, and 8-nitro-1,6-naphthyridine, 1,5-, 1,6-, 1,7-, and 1,8-naphthyridine, and 1,3,5-, 1,3,6-, 1,3,7-, and 1,3,8-triazanaphthalene were measured and analyzed. Specific shielding effects of ring nitrogen atoms in these series were calculated and used to predict the chemical shifts of protons in isoquinoline. (auth)

**43283** THE INFRARED ABSORPTION SPECTRUM OF $^{18}O$-LABELED GLYCINE. **Laulicht, I.; Pinchas, S.; Samuel, D.; Wasserman, I. (Weizmann Inst. of Science, Rehovoth, Israel). J. Phys. Chem., 70: 2719-25(Sept. 1966).**

The infrared absorption of powdered 75 at. % $^{18}O$ $\alpha$-glycine was measured in the 4000 to 400-$cm^{-1}$ region in comparison with the absorption of the corresponding normal glycine. Assignment of the glycine absorption bands is discussed in the light of the observed $^{18}O$ isotopic shifts. It is shown that the 1334 to 1324-$cm^{-1}$ band attributed previously mainly to a $CH_2$ wagging has a pronounced C−C stretching character. The 894-$cm^{-1}$ band of normal glycine, which was assigned to its C−C stretching, is shown to be due probably to the $CO_2^-$ scissoring. The 700 to 685-$cm^{-1}$ band is assigned to the $CO_2$-rocking while that about 502 $cm^{-1}$ is attributed to an $NH_3^+$ group deformation. (auth)

**43284** DEUTERIUM ISOTOPE EFFECT IN THE REACTION OF TERT-BUTOXY RADICALS WITH ALIPHATIC KETONES. **Schwetlick, K.; Spitz, R. (Technische Univ., Dresden). J. Prakt. Chem., 30: 218-24(1965). (In German).**

The reactivity of acetone, diethyl ketone, cyclohexanone, and the corresponding $\alpha$-deuterated ketones in the abstraction of H by tert-butoxy radicals was determined. The substituted ketones were prepared by base-catalyzed exchange; tert-butanol-$^2H$ was prepared by hydrolysis of Al tert-butoxide in $D_2O$. Purity was determined mass spectrometrically. Solutions (5%) of the peroxide in the ketone to be studied were heated to 135 ± 0.5°C for 24 hours. Products of the reaction were analyzed quantitatively by gas chromatography. The $\alpha$-methylene groups of diethyl ketone are 13 times more reactive than the $\beta$-methylene groups. In cyclohexanone the two $\alpha$-methylene groups are ten times more reactive overall than the three $\beta$- and $\gamma$-methylene groups. The $^2H$-isotope effect for abstraction of H from the $\alpha$-position is 5.4 for acetone, 3.9 for diethyl ketone, and 1.4 for cyclohexanone. The magnitude of the effect is comparable to that for the abstraction of H from toluene. (BBB)

**43285** INFRARED ABSORPTION SPECTRUM OF MONOCRYSTALS OF SODIUM URANYL ACETATE. **Volodko, L. V.; Komyak, A. I.; Sleptsov, L. E. Zh. Prikl. Spektrosk., Akad. Nauk BSSR, 3: 65-71(July 1965). (In Russian).**

The infrared absorption spectrum of monocrystals of sodium uranyl acetate at room temperature was studied by means of a doublebeam spectrometer UR-10. The splitting of a number of absorption bands into three components was established. The vibrations of atoms in a crystal of point T is related to types of symmetry by the group theory method and the splitting of bands into components is interpreted. The size of the split is in agreement with that observed earlier in the luminescence spectrum of crystalline sodium uranyl acetate at the temperature of liquid hydrogen. (auth)

**43286** POLY(IMIDAZOPYRROLONES): A NEW CLASS OF RADIATION RESISTANT POLYMERS. **Bell, Vernon L.; Pezdirtz, George F. (Langley Research Center, Hampton, Va.). 11p. (CONF-650902-33). ORAU. Gmelin, AED-CONF-65-235-72.**

From American Chemical Society, 150th National Meeting, Atlantic City.

Poly(imidazopyrrolones) were prepared by controlled reactions of dianhydrides and tetraamines. The primary preparation was poly(oxy-7H,15H-2,10-bis-benzimidazo-[1,2-a:1′,2′-a′]benzo[1,2-c:4,5-c′]dipyrrol-7,15-dione). The proposed ladder structure of the polymers is supported by infrared spectra of thin films. Polymer films were found to have excellent tensile strengths, low elongation, and unusually high modulus value. Initial tests showed very high radiation resistance and thermal stability. Some possible uses of the polymer are suggested. (A.G.W.)

**43287** EQUILIBRIUM AND KINETIC $D_2O$ SOLVENT ISOTOPE EFFECTS INVOLVING N...H-O AND N-H...O INTRAMOLECULAR HYDROGEN BONDS. **Haslam, John L.; Eyring, Edward M. (Univ. of Utah, Salt Lake City). 6p. (CONF-660320-5). ORAU. Gmelin, AED-CONF-66-051-6.**

From American Chemical Society, 151st Meeting, Pittsburgh.

Acid dissociation constants in water and $D_2O$ were determined for several azo dyes and related compounds, including Tropaeolin 0, 4′-nitro-2, 4-dihydroxyazobenzene, N,N′-dimethylanthranilic acid, methyl red, and yellow AB. Solvent $D_2O$ kinetic isotope effects for several of these acids were also determined by the temperature jump method for reactions of the type $HA^- + OH^- \rightarrow A^{-2} + H_2O$ where $HA^-$ denotes the monoanion of the sample acid. Relative strengths of N−H...O, N...H−O and O−H...O intramolecular hydrogen bonds are considered briefly in the light of these and other data, and the potential importance of these solvent kinetic isotope effects for the interpretation of biochemical reaction mechanisms is also discussed. (auth)

# Radiation Chemistry

***See also* BIOLOGY AND MEDICINE —**
**Radiation Effects on Biochemicals**
**Radiation Effects on Tissues**

*Refer also to abstracts 42826, 43550, 44011, 44436, and 45024.*

**43288** (CALT-532-1) STUDIES IN CHEMICAL DYNAMICS AND RADIATION CHEMISTRY. **Technical Progress Report, July 1, 1965–June 30, 1966. Kuppermann, Aron (California Inst. of Tech., Pasadena). Contract AT(04-3)-532. 52p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.**

Developments are reported for studies on: diffusion kinetics; low-energy electron scattering; vacuum uv photolysis of hydrocarbons; reactions of monoenergetic deuterium atoms with hydrogen molecules; reactions in crossed molecular beams; classical trajectory calculations; quantum mechanical calculation of dissociation cross sections;

and reaction cross sections and thermal rate constants. (P.C.H.)

**43289** (CALT–532-2) REACTION OF MONOENERGETIC DEUTERIUM ATOMS WITH HYDROGEN MOLECULES. White, John Michael (Illinois Univ., Urbana. Dept. of Chemistry and Chemical Engineering). 1966. Contract AT(04-3)-532. 327p. Dep. mn. CFSTI $7.00 cy, $1.50 mn.

Thesis.

The photolysis of $DI-H_2$ mixtures was studied using monochromatic light of variable wavelength that furnishes deuterium atoms whose initial velocities are known. The variation of the $(D_2/HD)$ product ratio with $(DI/H_2)$ reactant ratio was studied at 2537, 3030, 3130, 3340, and 3660 Å. These wavelengths furnish deuterium atoms with initial relative velocities in the range $1.32 \times 10^6$ to $0.54 \times 10^6$ cm $sec^{-1}$ (or relative energies in the range 0.90 to 0.15 ev). Also, the photolysis of $DBr-H_2$ mixtures was studied at 2537 Å, which furnishes deuterium atoms having an initial velocity of $1.05 \times 10^6$ $cm^{-1}$ (or energy of 0.57 ev). By comparing the limiting values of $(D_2/HD)$ for a large excess of hydrogen with those obtained in a large excess of helium, the variation of $(k_3/k_4)$ was determined for the reactions $D^* + H_2 \rightarrow DH + H$ and $D^* + H_2 \rightarrow D + H_2$. The observed results show that $(k_3/k_4)$ has a threshold velocity of $(0.80 \pm 0.02) \times 10^6$ cm $sec^{-1}$ which corresponds to a threshold energy of $0.33 \pm 0.016$ ev or $7.7 \pm 0.38$ kcal $mole^{-1}$. The results obtained using DBr as the source of the hot hydrogen atoms were consistent with those obtained using DI as the hot atom source. (P.C.H.)

**43290** (COO–1528-7) PARAMAGNETIC RELAXATION CHARACTERISTICS OF TRAPPED ELECTRONS AND HYDROGEN ATOMS IN IRRADIATED FROZEN AQUEOUS SOLUTIONS. Kevan, Larry (Kansas Univ., Lawrence. Dept. of Chemistry). June 29, 1966. Contract AT(11-1)-1528. 15p. (CONF-660614–4). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 3rd International Congress on Radiation Research, Cortina, Italy.

Paramagnetic relaxation experiments designed to probe the nature of the trapping site of trapped H atoms and electrons are described. Studies on gamma irradiated frozen NaOH, $H_2SO_4$, and $H_2O$ led to the conclusion that the electron is trapped in an anion vacancy which is located within a radiation-produced spur. However, the H atom is not trapped in a spur but is presumably trapped in an interstitial position in the region of an oxyanion. If $T_1$ for a given trapped species varies in different matrices (glassy or polycrystalline) the trapping probability in these matrices appears to be a function of the reciprocal of $T_1$. (P.C.H.)

**43291** (IA–1096) HIGH ENERGY CHEMICAL REACTIONS IN THE GASEOUS PHASE. Amiel, S.; Paiss, Y. (Israel Atomic Energy Commission, Yavne. Soreq Nuclear Research Center). 1966. 19p. (CONF-660431–5). Dep. mn.

From Symposium on Hot Atom Chemistry, Lafayette, Ind.

The possibility of displacement reactions taking place at energies much higher than 10 ev was investigated. The upper energy limit for which a reaction will yield a stable product is determined by the decomposition of the product after formation. A molecule produced at high energy may decompose either due to excess excitation or by collision with neighboring molecules. Internal excitation may be reduced by having high momentum transfer to the displaced atom (i.e., the projectile and the displaced atom are of similar masses) and choosing the rest of the molecule to be of low mass, thus minimizing the stretch of bonds. A molecule formed at high energy but with low internal excitation may still have high translational energy; which may be converted to excitation energy upon collision and thus cause decomposition. However, the molecules can survive collisions if the collisions take place with very light atoms, so that there is a low energy loss per collision. Experimental evidence using the $CH_3I + I^*$ reaction in the presence of rare gases is presented and discussed. (auth)

**43292** (ORO–2968-21) RECENT STUDIES OF RADIATION-INDUCED CATIONIC POLYMERIZATION. Williams, Ffrancon (Tennessee Univ., Knoxville. Dept. of Chemistry). [1966]. Contract AT(40-1)-2968. 20p. (CONF-660503–4). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 7th Japanese Conference on Radioisotopes, Tokyo.

Developments in radioinduced cationic polymerization, with particular emphasis on the kinetic aspects, are discussed. Conditions favoring the occurrence of ionic reactions and the criteria by which such polymerization processes can be recognized in bulk monomer systems are considered, along with general kinetics and the contribution of these studies to the general theory of ionic polymerization. (P.C.H.)

**43293** (AD–633448) CHEMICAL DOSIMETRY OF IONIZING RADIATIONS. Kabakchi, A. M.; Lavrentovich, Ya. I.; Pen'kovskii, V. V. Translated from pp 1-76; 86-92; 105-35 of Khimicheskaya Dozimetriya Ioniziruyushchikh Izluchenii, Izdatel'stvo Akademii Nauk Ukrainskoi SSR, Kiev, 1963. 166p. (FTD-TT–65-420). CFSTI $5.00 cy, $1.00 mn.

Information is included on: radiation dose and methods of measuring it; fundamentals of radiation dosimetry; and methods of chemical dosimetry, including aqueous solutions and gels, glasses and ionic crystals, and electrochemical methods. (P.C.H.)

**43294** RADIATION-INDUCED GRAFT POLYMERS OF CELLULOSE. Arthur, Jett C. Jr.; Blouin, Florine A. (Dept. of Agriculture, New Orleans). Amer. Dyestuff Rep., 51: 1024-7(Dec. 24, 1962).

A review of the radiation chemistry of cellulose, graft polymerization reactions, and the textile and thermoelastic properties of graft polymers of cellulose is presented. On the basis of the properties of cotton cellulose that were examined, the major molecular changes that occur on irradiation of cellulose are depolymerization and formation of acid and reducing groups. The ratio of the number of chain cleavages to the number of acid groups formed to the number of reducing groups formed is 1 : 0.5 : 19. The crystalline-amorphous nature of the cellulose structure apparently is not changed by high-energy radiation. Optical and electron microscopic observations of irradiated cotton cellulose showed that no visible effect on cellulose structure is produced at doses less than $10^6$ R. At higher doses, the fibrillate character of the cotton was progressively lost. With increasing radiation dose, the solubility of degradation products in water and dilute sodium hydroxide increased. The radiochemical yields of the major molecular changes in cotton cellulose in an oxygen atmosphere were about 14 ev of energy per chain cleavage, 1.4 ev per reducing group formed, and 12 ev per acid group formed. These relatively high values indicate that, at least in the case of cleavage and acid groups, chain reactions are not initiated in the cellulose molecule by radiation. Experimental procedures designed to give maximum radiochemical yields of graft polymerization reactions are discussed, and some important factors influencing the radiochemical yield of graft polymerization reactions of styrene and acrylonitrile onto cotton cellulose are considered. (BBB)

**43295** RADIOLYSIS OF A BINARY MIXTURE OF TETRAHYDROFURAN WITH FURAN. Matsui, Masao (Inst. of Physical and Chemical Research, Tokyo). Bull. Chem. Soc. Jap., 39: 1640-3(Aug. 1966).

Radiolysis of a tetrahydrofuran (THF) and furan system was studied at a dose of about $2 \times 10^{19}$ ev $ml^{-1}$ of $^{60}Co$ $\gamma$ rays, and the hydrogen, which may be formed with no opening of the ring, and the carbon monoxide, which should be formed by the ring scission, were determined. The decrease in the hydrogen yield with an increase fraction of furan was found to be greater than was expected, while G(CO) fit the expected value. The charge transfer mechanism was presumed for the decrease in the hydrogen yield in the $\gamma$-radiolysis of this mixture. Suggestions were made on the probable mechanism of the ring opening of the excited molecule for the formation of carbon monoxide, and on the ionic reaction for hydrogen formation. Furthermore, the probability of the ring scission of the THF molecule was roughly estimated by using the assumed decomposition reaction and the determined G values. (auth)

**43296** CORRELATIONS OF THE STRUCTURAL UNIT OF ORGANIC COMPOUNDS WITH THE G VALUES OF THEIR RADIOLYTIC PRODUCTS. Isoya, Toshiro; Hirota, Kozo; Hatada, Motoyoshi (Japanese Association for Radiation Research on Polymers, Osaka. Osaka Univ.). Bull. Chem. Soc. Jap., 39: 1878-86(Sept. 1966).

Two correlations were found between the G values of the radiolytic products and the number of the structural unit, n, in an organic molecule. The G value from the homologous compounds has a linear relation to 1/n in the $n \leqq m$ region and is independent of n in the $n \geqq m$ region, where m is the number of the C—C bond through which the energy can be transferred; and the G($CH_4$) value from paraffin hydrocarbons, where the "terminal effect" is remarkable, has a linear relation to 1/n in both the $n \geqq m$ and $n \leqq m$ regions. These relations may be explained in terms of the energy transfer through C—C bonds. (auth)

**43297** ELECTRON SPIN RESONANCE OF IRRADIATED SINGLE CRYSTALS OF DICHLOROACETAMIDE. Kashiwagi, Michio (Toyo Rayon Co., Ltd., Kamakura, Japan). Bull. Chem. Soc. Jap., 39: 2051-2(Sept. 1966).

The chlorine coupling found in x irradiated single crystals of dichloroacetamide and the hyperfine couplings for N and H nuclei of the amide group are reported. (D.H.M.)

**43298** RADIATION-INDUCED ADDITION OF HBr TO OLEFINS IN THE LIQUID PHASE. Rumfeldt, R. C. (Univ. of Windsor, Ont.); Armstrong, D. A. Can. J. Chem., 44: 2219-20(Sept. 15, 1966).

The results of a kinetic study of the production of ethyl bromide, catalyzed with $^{60}$Co, at −79°C and in the liquid phase are reported. Ethylene and propylene mixed with HBr were the materials exposed to ionizing radiation. Results obtained are all consistent with a free-radical mechanism for radioinduced addition of HBr to ethylene and propylene in the liquid phase. (F.S.A.)

**43299** MODIFICATION OF COTTON FABRICS BY GRAFT POLYMERIZATION. DasGupta, Sharda (Atomic Energy of Canada Ltd., Ottawa, Can.). Can. Textile J., 18: 57-63(June 19, 1964).

Use of $^{60}$Co $\gamma$ radiation for grafting styrene to cotton fabric was studied. Vacuum dried fabric samples were soaked in monomer solutions for different intervals and irradiated to various doses with a dose rate of 1 Mrad/hr. A greater yield per unit dose was obtained with a low dose rate. The effect of varying the percentage of water in the monomer solution was studied. A 10- to 12-fold increase in grafting was noted with the addition of small quantities of water, and the increases were marked up to about 20% water after which the probability of polymer precipitation increased. At a constant water content of 15% very little or no change was observed in the polymer weight increase with various ratios of monomer to methyl hydrate to a monomer concentration above 20%, except that the samples became stiff and the polymer precipitated. The physical properties of the grafted products are greatly superior to those of the starting materials with regard to tensile strength, wet and dry crease recovery, retention of crease after treatment with alkali and chlorinated solvents, resistance to fungus growth, and other important features. These properties are discussed in detail. Mechanisms of the reaction are also considered. (BBB)

**43300** FISSION RECOIL SYNTHESIS. Steinberg, M. (Brookhaven National Lab., Upton, N. Y.). Chem. Eng. Progr., 62: No. 9, 105-16(Sept. 1966). (BNL-9985).

The use of fission recoil energy to produce large quantities of basic chemicals at costs comparable to conventional methods is discussed. Fixation of nitrogen, ozone synthesis, carbon dioxide decomposition, decomposition of water vapor, hydrogen peroxide synthesis, hydrazine synthesis, and hydrogen cyanide synthesis are some of the fission fragment chemonuclear reactions considered. Other topics discussed are: fissiochemonuclear source and reactor fuel development; foil stability; reactor physics; contamination problems; in-pile loop construction; economic evaluation; need of dual-cycle system; parametric cost analysis; reduction of capital investment; requirement of large-size plants; synthesis gas plants; ozone production; and treatment of large volumes. (D.H.M.)

**43301** POLYMERIZATION OF TETRAFLUORO ETHYLENE OXIDE. Barnaba, P.; Cordischi, D.; Lenzi, M.; Mele, A. (CNEN, Rome. Univ., Rome). Chim. Ind. (Milan), 47: 1060-4(1965). (In Italian). (RT/CHI(66)1).

Radioinduced polymerization of tetrafluorethylene oxide, in the solid state, was studied. Polymerization was not possible by liquid monomer irradiation. Temperature influence on polymerization rate and on polymer molecular weight was examined. Rate of polymerization and molecular weight of the polymer reached their maximum in the proximity of melting point. The polymer obtained was highly crystalline and partially oriented. (auth)

**43302** ABSORPTION PROPERTIES OF IRRADIATED QUARTZ. Starodubtsev, S. V.; Vasil'eva, E. K. (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Dokl. Akad. Nauk Uz. SSR, No. 5, 17-19(1966). (In Russian).

An analysis of nitrogen and hydrogen adsorption on $\gamma$-irradiated melted and crystalline quartz containing various amounts of Al and Fe showed that damaged crystalline lattice and structural disordering of the adsorbant play the most important part in the adsorption process. Al atom impurities combined with structural defects act as adsorption centers. Nitrogen and hydrogen adsorption in melted quartz was considerably higher than in crystal specimens with identical amounts of impurities. (R.V.J.)

**43303** INFLUENCE OF NUCLEAR IRRADIATION ON PROPERTIES OF ALKALI-HALIDE CRYSTALS. Andronikashvili, E. L. pp 5-12 of Elektronnye i Ionnye Protsessy v Tverdykh Telakh. I. Tbilisi, Georgian SSR, Izdatel'stvo Metsniereba, 1964. (In Russian).

A part of the paper delivered at the symposium on radiation damage on solids and reactor materials held in Venice (May, 1962) is given. Questions are considered about interrelation between different types of defects and different types of hardness and between point defects and collective ones of dislocation type. Previously the effect of radiation generation of dislocations in alkali halide crystals (KCl, LiF) under the action of reactor radiation was found experimentally. To explain the results obtained in a study of formation of point defects, different assumptions were developed for the possibility of formation of new dislocations during the process of irradiation. Questions on interrelation of radiation generation of dislocations, of point defects, and on the possible mechanisms of these processes are considered. (D.H.M.)

**43304** INFLUENCE OF STRUCTURAL DISLOCATIONS ON MECHANICAL PROPERTIES OF IRRADIATED CRYSTALS. Andronikashvili, E. L.; Politov, N. G.; Vorozheikina, L. F.; Abramishvili, M. G. pp 13-30 of Elektronnye i Ionnye Protsessy v Tverdykh Telakh. I. Tbilisi, Georgian SSR, Izdatel'stvo Metsniereba, 1964. (In Russian).

Investigations were made of the influence of irradiation with x rays, gamma rays, and reactor radiation on different types of hardness of potassium chloride crystals and lithium fluoride crystals: microhardness $H_M$, scratching hardness $H_S$, and hardness according to attenuation of pendulum $H_P$. Hardness was measured on fresh splitting surfaces (100) of samples cut from one single-crystal ingot. Optical absorption spectra were measured. The effect of KCl crystal softening was observed as a result of formation of F-centers under the influence of x rays. Discoloration of crystals led to restoration of hardness $H_P$. Crystals of LiF, irradiated with x rays and gamma rays, were strengthened despite the formation of F-centers. The same defects of structure in KCl crystals created by neutron fluxes influenced different types of hardness. Elimination of thermal neutrons by means of a cadmium filter did not influence the dose dependence of different types of KCl crystal hardness. Changes in temperature of irradiation were accompanied by a change in the behavior of hardness.

Hardness $H_5$, which at first decreases under irradiation at ordinary temperatures, increased from the very beginning under low-temperature irradiation. LiF crystals did not behave in the same way as KCl crystals. All the three types of LiF hardness began to increase at the initial stage of irradiation. Elimination of the thermal neutrons did not influence the character of dose dependence of different types of hardness. The observed decrease of the hardness not exceeding 30% can be connected with the reaction $^6Li(n,\alpha)^3H$. Low-temperature irradiation of LiF crystals led to smaller radiation strengthening than irradiation at usual temperatures. The process of radiation hardening was completely reversible. For crystals of LiF, annealing at 600°C for three hours completely removed independent hardening. The influence of isothermic annealing (at 300° and 700°C) is discussed. (D.H.M.)

**43305** RADIATION EFFECTS ON DISLOCATION DENSITIES IN IONIC CRYSTALS. Andronikashvili, E. L.; Politov, N. G.; Getiya, M. Sh. pp 31-41 of Elektronnye i Ionnye Protsessy v Tverdykh Telakh. I. Tbilisi, Georgian SSR, Izdatel'stvo Metsniereba, 1964. (In Russian).

The effects of neutron irradiation in a reactor on the density of dislocations in lithium fluoride and potassium chloride crystals are discussed. Dislocations were developed by the method of chemical etching. The two halves of the same crystal, obtained by splitting, were investigated. One half was irradiated and the other one was kept as a control. Both halves were etched simultaneously and two surfaces of the same splitting were compared. At small radiation doses no changes in microstructure were found. At doses above $3 \times 10^{15}$ nvt microphotos of the irradiated and nonirradiated halves began to differ appreciably. The decrease of the size of the figures of etching on the irradiated surfaces in comparison with the nonirradiated ones indicated radiation strengthening. By increasing the time of etching the dimensions of figures etched on the irradiated surface can be increased to correspond to the nonirradiated half. Measurements were performed by determination of the number of dislocations on arbitrary sections of the crystal with each point for dose dependence of dislocation density D obtained by averaging results of counting over 150 sections of a series of crystals, and determination of the relative change of the number of dislocations on the irradiated surface in comparison with the number of dislocations on the control surface. After counting was performed the relative change of dislocation density $D/D_0$ was calculated. Both methods gave the same course of change of dislocation density with increases of the integral neutron flux. The existence of maxima on the curves showed the presence of competing processes during the irradiation, which led to a decrease in the registered number of dislocations. The effect of dislocations becoming "younger" was observed in irradiated crystals. Change of microstructures of irradiated crystals was rather stable. The isochronic annealing (during three hours) made with the same series of crystals led to a significant change of the dislocation picture only at annealing temperatures above 300°C. At an annealing temperature of 700°C the surface of the crystal was covered with pores. (D.H.M.)

**43306** LOCAL CENTERS IN IRRADIATED IONIC CRYSTALS. Davitashvili, T. Sh.; Politov, N. G. pp 42-54 of Elektronnye i Ionnye Protsessy v Tverdykh Telakh. I. Tbilisi, Georgian SSR, Izdatel'stvo Metsniereba, 1964. (In Russian).

The influence of microstructure changes in potassium chloride crystals on the optical properties of centers of coloration was studied by reactor irradiation. By irradiation with comparatively small integral neutron fluxes (to $3.6 \times 10^{16}$ nvt), in the optical absorption spectra the 310 mμ band ($\lambda_{max} = 310$ mμ), in addition to F and K bands, was observed. The 270 mμ band and a better developed 310 mμ band were observed because of discoloration with F-light at the temperature of liquid nitrogen. The increase of the integral neutron flux (to $3.6 \times 10^{17}$ nvt) causes the appearance of a 600 mμ band and of the bands corresponding to the aggregate $R_1$, $R_2$, M, and N centers. The shape and the halfwidth of the F-band connected with F-centers created by x irradiation and by reactor irradiation were investigated. The shape of the F-band is conserved. The effect of broadening of the F-band, which is not the result of overlapping of F-band with K-band or with band 600 mμ was found. F-band broadening is connected with the peculiarities of reactor radiation effects on the crystal lattice, which leads to change of the extent of interaction of an F-center with the lattice. The dependence of the halfwidth of the F-band on the integral neutron flux was studied. Appearance of the band at 600 mμ as a result of the reactor irradiation depended on the introduction of impurities of an alkali metal. The lithium impurity caused appearance of a new 620 mμ band. In crystals irradiated at low and room temperatures a 230 mμ band identified with $V_2$-centers of coloration was observed. The possibility of $V_2$-center formation under the conditions of reactor irradiation, both at low and at room temperatures and the stability of this band at room temperature showed some peculiar conditions of bound hole existence in crystals irradiated by neutrons. Crystals irradiated in a reactor and then discolored either thermically or optically can color under the action of the residual radioactivity (selfcoloration). Absorption spectra before and immediately after optical discoloration and after selfcoloration are given, and the dependence of the intensity of the F-band on the duration of selfcoloration is given. Change of microstructure under the action of neutron fluxes changed optical characteristics of local centers and led to the formation of new centers. (D.H.M.)

**43307** INFLUENCE OF ROENTGEN IRRADIATION ON SOME PROPERTIES OF MONOCRYSTALS OF LITHIUM FLUORIDE. Golubeva, L. A.; Pchelinskaya, S. N.; Smiryagina, S. A.; Shishelov, A. A. (Kalinia Politekhnicheskii Institut, Leningrad). Fiz. Tverd. Tela, 8: 680-3(Mar. 1966). (In Russian).

Changes in lattice constant for LiF as a function of radiation dose were determined: $2.1 \times 10^6$ R, $0.61 \times 10^{-4}$ A; $4.2 \times 10^6$ R, $0.93 \times 10^{-4}$ A; $10.5 \times 10^6$ R, $1.10 \times 10^{-4}$ A; $14.7 \times 10^6$ R, $1.41 \times 10^{-4}$ A; $86.7 \times 10^6$ R, $2.46 \times 10^{-4}$A. Changes in the tangent of the angle of dielectric losses (tan δ) were studied as a function of dose. Data are illustrated for the dependence of tan δ on frequency between 1.9 and 4 cps before irradiation, after $1.5 \times 10^8$ R, after $3.0 \times 10^8$ R, and after treatment of the surface with $HNO_3$ before a dose of $3.0 \times 10^8$ R. On irradiation tan δ increases, with maxima at 2.0 and 3.8 cps ($8 \times 10^{-4}$ and $1 \times 10^{-3}$, respectively) for the $1.5 \times 10^8$ R dose and further increases to $2 \times 10^{-3}$ and $1.6 \times 10^{-3}$ at $3.0 \times 10^8$ R (the maxima become shoulders on the sides of values at lower and higher frequency, respectively). Prior treatment of the sample with $HNO_3$ produces some slight (ca $2 \times 10^{-4}$) decrease in tan δ throughout the frequency spectrum. On short irradiation periods a decrease in the value of tan δ is observed, the value for the maxima decreasing about 50%. (BBB)

**43308** STUDIES ON RADIATION-INDUCED IONIC POLYMERIZATION. I. SOLUTION POLYMERIZATION OF STYRENE AT LOW TEMPERATURE. Ueno, K.; Yamaoka, H.; Hayashi, K.; Okamura, S. (Kyoto Univ.). Int. J. Appl. Radiat. Isotop., 17: 513-19(Sept. 1966).

The radioinduced ionic polymerization of styrene at −78°C was studied in various solvents. Cationic polymerizations occur not only in methylene chloride, but also in carbon disulfide, ethylbromide, and monofluorotrichloromethane. It was concluded that the initiating species are derived neither from the acid formed by radiolysis of solvents nor solely by proton transfer from solvents. From considerations on the G-value, a mechanism in which almost all the energy absorbed in solvent is transferred to styrene is proposed. G-value obtained assuming no chain transfer is 0.1−0.2, which agrees well with G of free ion previously reported. The relationship between dielectric constant of solvent and kinetic results of this polymerization is not so clear as in conventional cationic polymerizations. (auth)

**43309** EPR SPECTRA OF IRRADIATED FROZEN AQUEOUS SOLUTIONS. 2. AQUEOUS SOLUTIONS OF SODIUM NITRITE. Ershov, B. G.; Pikaev, A. K.; Glazunov, P. Ya.; Spitsyn, Vikt. I. Izv. Akad. Nauk SSSR, Ser. Khim., No. 10, 1758-63(1965). (In Russian).

The EPR spectra of irradiated frozen aqueous solutions of sodium nitrite in acid, neutral, and alkaline media were investigated. The EPR spectra of acid and neutral solutions are identical and $NO_2$ radicals were formed whereas in alkaline media two radicals $NO_2^{2-}$ and $O^-$ were formed. The yield of radicals at temperatures of –196 and –150°C were altered as a function of the $NaNO_2$ concentration and the alkali. With increase in concentration of these compounds, the radical yield increased. Possible reasons for this phenomenon were considered. The thermal stability of the radical products formed during irradiation was investigated and it was determined that under the given conditions the radicals OH and $O^-$ in warming processes interact with $NO_2^-$ ions. (tr-auth)

**43310** EPR SPECTRA OF IRRADIATED FROZEN AQUEOUS SOLUTIONS. III. AQUEOUS SOLUTIONS OF SODIUM NITRATE. Ershov, B. G.; Pikaev, A. K.; Glazunov, P. Ya.; Spitsyn, Vikt. I. (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izv. Akad. Nauk SSSR, Ser. Khim., No. 11, 1919-27(1965). (In Russian).

The EPR spectra of frozen irradiated aqueous solutions of sodium nitrate were investigated in acid, neutral, and alkaline media. At –196° the EPR spectra of acid solutions indicated the radicals $NO_2$ and $NO_3$, whereas in neutral media the ion radicals $NO_3^{2-}$ (product of the addition of electrons to $NO_3^-$) appeared. In alkaline solutions lines of the radical $NO_3^{2-}$ dominated in the EPR spectrum but the radicals OH were transformed into the ion radicals $0^-$. The yields of radical products at –196 and –150° were measured as a function of the concentrations of $NaNO_3$ and the alkali. With increase of the concentration of these substances, the radical yields increased. Possible causes of this phenomenon are discussed. The thermal stability of the radicals formed during irradiation was investigated and it was established that under the given conditions the OH radicals interact with the ions $NO_3^-$ during the melting process. (tr-auth)

**43311** RADIATION-CHEMICAL SYNTHESIS OF NEW MINERAL-ORGANIC ION-EXCHANGE MATERIALS. Egorov, E. V.; Morozov, Yu. L.; Khomutov, A. I. (Inst. for Chemical Physics, Academy of Sciences, USSR. Inst. for Heteroorganic Compounds, Academy of Sciences, USSR. All Union Scientific Research Inst. for Fiber Glass, USSR). Izv. Akad. Nauk SSSR, Ser. Khim., No. 11, 2071-2(1965). (In Russian).

The possibility of obtaining new ion exchange materials by means of a gas-phase radiation-chemical synthesis was investigated. The synthesis consisted of graft polymerization of styrene, vinylpyridine, and dichloranhydride of vinylphosphonic acid to silica gel, fiber glass, and zirconium oxide. The radiation-chemical yield and the yield of homopolymer and graft polymer as a function of radiation dosage are tabulated. The rate of ion exchange between $H^+$ and $Na^+$ was also investigated. It was found that the ion exchangers had an exchange capacity of 1 to 2 mg/g, did not swell in aqueous solution, and possessed high radiation-chemical stability. (P.C.H.)

**43312** CHEMICAL EFFECT OF IONS AND ELECTRONS RECOMBINATION IN THE IRRADIATED n HEPTANE AT 77 DEG K. Frankevich, E. L.; Yakovlev, B. S. (Inst. of Chemical Physics, Academy of Sciences, USSR). Izv. Akad. Nauk SSSR, Ser. Khim., 12: 2226(1965). (In Russian).

Hydrogen emission was observed during light illumination of several micron thicknesses of irradiated heptane coated inside or flask submerged in liquid nitrogen. The heptane was irradiated in a vacuum with 1.5-Mev electrons. A mass spectrometric analysis of heptane irradiated with 1- and 3-Mrad doses showed a radiation hydrogen emission of G ~0.8. It was established that recombination of charges in heptane produced hydrogen. (R.V.J.)

**43313** MOLECULAR IONS IN RADIATION CHEMISTRY. IV. OPTICAL AND ELECTRON PARAMAGNETIC RESONANCE STUDIES OF IONS OF ALIPHATIC AND AROMATIC KETONES. Shida, Tadamasa; Hamill, William H. (Univ. of Notre Dame, Ind.). J. Amer. Chem. Soc., 88: 3683-9(Aug. 20, 1966). (COO–38-466).

A number of aliphatic and aromatic ketones were γ irradiated at –196°, either pure and polycrystalline or in various glass-forming solvents. Pure acetone exhibited broad absorption bands at 460 and 740 mμ after irradiation, the first attributable to $CH_3COCH_3^+$, the second to $CH_3COCH_3^-$. Each band was also observed in solvents where the positive charge and electron are available to solute acetone. In an alcohol matrix acetone anion reacted with the substrate according to $ROH + CH_3COCH_3^- \rightarrow RO^- + CH_3\dot{C}OHCH_3$, confirmed by EPR. The septet of irradiated 2-propanol was unaffected by addition of acetone since both solvent and solute form the 2-propanol radical. In pure acetone the cation partially undergoes the reaction, $CH_3COCH_3^+ + CH_3COCH_3 \rightarrow CH_3\dot{C}OHCH_3^+ + CH_3CO\dot{C}H_2$, substantiated by mass spectrometry. The recombination luminescence of irradiated acetone consisted of a band at 455 mμ, corresponding to the combined fluorescence-phosphorescence of acetone. $\lambda_{max}$ of alkyl ketone cations depends upon the alkyl group, probably due to hyperconjugation. Bensophenone forms the molecular anion with $\lambda_{max}$ ~800 mμ in olefin, ether, and amine matrices but $\lambda_{max}$ ~600 mμ in alcohols, the blue shift being attributable to H bonding. On limited warming the latter is replaced by a new band at $\lambda_{max}$ 554 mμ, known to be $(C_6H_5)_2\dot{C}OH$. (auth)

**43314** MOLECULAR IONS IN RADIATION CHEMISTRY. V. INTERMEDIATES IN γ-IRRADIATED GLASSY SOLUTIONS OF METHANOL. Shida, Tadamasa; Hamill, William H. (Univ. of Notre Dame, Ind.). J. Amer. Chem. Soc., 88: 3689-94(Aug. 20, 1966). (COO-38-467).

γ-Irradiated methanol glass at –196°C produces solvent-trapped electrons which are scavenged by solute aromatic hydrocarbons. Benzene and alkylated benzenes capture electrons to form molecular anions which, in turn, react rapidly with methanol by the reaction, $S^- + ROH \rightarrow SH + RO^-$. The cyclohexadienyl-type radicals thus formed have optical absorption bands in the near-ultraviolet. Aromatic vinyl compounds also undergo the same reaction, the net effect being H-atom addition to the terminal carbon of the vinyl group. The transformation of biphenyl anion to phenylcyclohexadienyl radical is measurably slow at –196°. The solvent-trapped electron can be photobleached giving an H atom by the reaction, $(e^-) + ROH + h\nu \rightarrow RO^- + H$. The H atom adds to the solute olefins, ethylene, propylene, butene-1, and isobutene, to yield the respective radicals, ethyl, isopropyl, sec-butyl, and t-butyl. The same radicals are produced also from the solutions of ethyl bromide, isopropyl chloride, sec-butyl chloride, and t-butyl chloride, respectively, by the dissociative electron attachment, $RX + e^- \rightarrow R + X^-$. (auth)

**43315** REACTION OF RECOILING SILICON ATOMS WITH PHOSPHINE AND SILANE. Gaspar, Peter P.; Pate, Brian D.; Eckelman, William (Washington Univ., St. Louis). J. Amer. Chem. Soc., 88: 3878-9(Aug. 20, 1966).

Silane was found to be the only radioactive product in the neutron irradiation of pure phosphine. Addition of cold silane to the reaction mixture prior to neutron irradiation resulted in an increase in the yield of radioactive silane and the appearance of a new radioactive product, disilane ($Si_2H_6$). In an effort to determine whether thermal energy silyl radicals ($-SiH_3$) were necessary precursors to production of radioactive silane in these reactions, an ethylene scavenger was added to the mixture. Results indicated that the radioactive products do not result from the reactions of silyl radicals at thermal energies, but from the reactions of species not efficiently scavenged by ethylene. (J.G.B.)

**43316** NONDISSOCIATIVE ELECTRON ATTACHMENT REACTIONS IN γ RADIOLYSIS OF SOLUTIONS OF CYCLIC PERFLUOROCARBONS IN ALKANES. Rajbenbach, L. A. (Soreq Nuclear Research Center, Yavne, Israel). J. Amer. Chem. Soc., 88: 4275-7(Sept. 20, 1966).

The effect of low concentrations of several perfluorocarbons on the hydrogen yield of $\gamma$-radiolyzed hexane and cyclohexane was studied. Deaerated dilute solutions of perfluorinated methane, ethane, cyclobutane, cyclohexane, methylcyclohexane, and benzene were irradiated using a cobalt-60 $\gamma$ source to a total dose of $1.1 \times 10^{19}$ ev ml$^{-1}$. It is suggested that the observed decrease in radiolytical hydrogen yield in a solution of cylic perfluorocarbons in alkanes is due to electron scavenging by these solutes. (J.G.B.)

**43317** TRANSFER PROCESSES IN IRRADIATED CRYSTALLINE SOLID SOLUTIONS. **Box, Harold C.; Freund, Harold G.; Budzinski, Edwin E. (Roswell Park Memorial Inst., Buffalo). J. Chem. Phys., 45: 2324-5 (1966). (NYO-3558-6).**

The intermolecular transfer of spins was studied in irradiated single crystals of $\alpha$-aminobutyric acid HCl containing approximately 2% cysteine HCl in solid solution. A crystal was x-irradiated at 77°K and transferred without appreciable warming to an ESR spectrometer. Warming the sample to 220°K produced an ESR spectrum attributed to the neutral free radical $CH_3-CH_2-\dot{C}H-COOH$(I). At room temperature another absorption became significant. The characteristics of this absorption indicated that it arises from a sulfur radical in which the unpaired electron is localized primarily on the sulfur atom of a cysteine molecule. The nascence of sulfur radicals and the transfer of paramagnetism from solvent to solute molecules appeared to result from the transfer of hydrogen from the sulfhydryl group of cysteine to the free radical (I). (A.G.W.)

**43318** THE $\gamma$ RADIOLYSIS OF LIQUID 2-PROPANOL. II. THE REACTION OF SOLVATED ELECTRONS WITH MONO- AND DISUBSTITUTED BENZENES. Sherman, Warren V. (Soreq Nuclear Research Centre, Yavne, Israel). J. Phys. Chem., 70: 2872-5(Sept. 1966).

The effect of a number of mono- and disubstituted benzenes on the gaseous products of the radiolysis of solutions of nitrous oxide in 2-propanol was studied. The substituted benzenes decrease the nitrogen yield, and this is interpreted as being due to competition with nitrous oxide for solvated electrons. From the measurements of $G(N_2)$ the relative reactivities of the substituted benzenes were calculated. The site of attack of the solvated electron appears to be the aromatic ring since the substituent effects correlate well with those found generally in aromatic bimolecular nucleophilic substitution. In addition, satisfactory correlation is observed between reactivity and the Hammett $\sigma_{para}$ functions. The $\rho$ value for the monosubstituted benzenes is 3.1. The $\rho$ value remains approximately constant for a given series of disubstituted benzenes in which one substituent is kept unchanged. However, the $\sigma$ values for disubstituted benzenes are not additive. (auth)

**43319** THE REACTION OF ISOPROPYLBENZENE ON $\gamma$-IRRADIATED SILICA GELS. Rojo, Enrique A.; Hentz, Robert R. (Univ. of Notre Dame, Ind.). J. Phys. Chem., 70: 2919-25(Sept. 1966). (COO-38-454).

Dealkylation of isopropylbenzene was studied on three $\gamma$-irradiated silica gels. Little or no visible coloration occurred in these solids on irradiation at 37°C to doses of $4 \times 10^{21}$ ev g$^{-1}$. The yield of benzene initially increased linearly with dose to the solid but approached a limiting value at large doses; for one of the solids, limiting yields was 2.6 and 15.5 in units of $10^{17}$ molecules (g of solid)$^{-1}$ at 37 and −196°C, respectively. Initial slopes corresponded to $G_0(C_6H_6) = 0.067$ at 37°C and $G_0(C_6H_6) = 4$ at −196°C, the latter value suggests a trapping efficiency for free charge carriers of near 100%. Room-temperature annealing of solid irradiated to saturation at −196°C gave a limiting yield identical with that attained in a 37°C. Therefore, the 37°C limiting yield must correspond to essentially complete population of certain solid defects. Room-temperature irradiation of solid irradiated to saturation at −196°C reduced the benzene yield at a considerably greater rate (than simple annealing) to the 37°C limit; G(loss in benzene yield) ≈ 4. Thus, the −196°C limiting yield appeared to correspond to a steady-state population of certain defects not populated appreciably at 37°C. A good correlation exists between the behavior of benzene yields on irradiated silica gel and the reported behavior of certain trapped-electron color centers associated with specific vacancies in a silica matrix. Results suggest that limiting yields, particularly at −196°C are not governed by aluminum content. Irradiation of isopropylbenzene adsorbed on silica gel also was studied. Results were similar to those obtained previously with a silica−alumina. The results suggest that dealkylation of adsorbed isopropylbenzene occurs under irradiation, $G(C_6H_6) \approx 2$, by direct capture of free charge carriers produced in the solid with an efficiency approximating that for their capture by silica matrix defects at −196°C. (auth)

**43320** RADIOLYSIS OF ETHYL MERCAPTAN. **Myron, J. J. J.; Johnsen, R. H. (Florida State Univ., Tallahassee). Contracts AT(40-1)-2001; AT(40-1)-2690. J. Phys. Chem., 70: 2951-5(Sept. 1966). (TID-22762).**

A study of the radiolysis of liquid ethyl mercaptan was undertaken. The data strongly suggest that the radiolytic behavior of the mercaptan differs significantly from that of the corresponding alcohol. A comparison of the two radiolyses in the light of the present results is presented. (auth)

**43321** PULSE RADIOLYSIS OF THE AQUEOUS NITRATE SYSTEM. FORMATION OF $NO_3$ IN CONCENTRATED SOLUTIONS AND THE MECHANISM OF "DIRECT ACTION." Daniels, Malcolm (Oregon State Univ., Corvallis). J. Phys. Chem., 70: 3022-4(Sept. 1966).

A 14- to 15-Mev electron beam from the ANL linear accelerator with pulses from 0.4 to 3 sec and beam currents of 40 to 160 ma was used to study the mechanism of nitrate formation during radiolysis of concentrated nitrate solutions. The nitrate radical detected was characteristic of the "direct effect" but was not a primary species, indicating that excitation is an important primary process in the direct effect. (P.C.S.)

**43322** STRUCTURAL MODEL OF THE HYDRATED ELECTRON. **Natori, Makoto; Watanabe, Tsutomu (Tokyo Univ.). J. Phys. Soc. Jap., 21: 1573-8(Aug. 1966).**

A structural model of the hydrated electron in the radiation chemistry of water and aqueous solutions is proposed. The energy levels of the hydrated electron were calculated. The binding energy is estimated at 2.4 ev. The excitation energy is estimated at 0.80 ev, which is comparable with the experimental data, 1.7 ev. The oscillator strength of this transition is calculated at 0.26. (auth)

**43323** POLYMERIZATION IN THE CRYSTALLINE STATE. IX. RELATION BETWEEN THE VELOCITY OF RADIATION-INDUCED IN-SOURCE POLYMERIZATION AND POST-POLYMERIZATION. **Morawetz, Herbert (Polytechnic Inst. of Brooklyn). J. Polym. Sci., Pt. A-1, 4: 2487-92(Oct. 1966).**

A general relation was derived between the polymerization velocities to be expected for crystalline monomers during irradiation at polymerization temperature and the post-polymerization observed in samples irradiated at very low temperatures and subsequently warmed outside the irradiation source. For acrylamide, the experimental data were in satisfactory agreement with the theoretical relationship. The possible reasons for a deviation from this relationship are discussed. (auth)

**43324** ESR STUDY OF FREE RADICALS FORMED BY $\gamma$-IRRADIATION OF POLY(ETHYLENE TEREPHTHALATE). Campbell, D.; Araki, K.; Turner, D. T. (Research Triangle Inst., Durham, N. C.). J. Polym. Sci., Pt. A-1, 4: 2597-2606(Oct. 1966).

Free radicals formed by $\gamma$ irradiation of oriented samples of poly(ethylene terephthalate) (PET) were studied at 25°C by ESR spectroscopy. The G value for trapped free radicals was 0.02. The predominant radical was identified as $-O-\dot{C}H-CH_2-O-$, and a minor component of the spectrum was tentatively assigned to the radical $-CO-\dot{C}_6H_3-CO-$. The absence of cyclohexadienyl type radicals is discussed. Previously reported dose rate effects in PET are explained by reference to a chain reaction involving $\beta$-bond scission of the radical $-O-\dot{C}H-CH_2-O-$. (auth)

**43325** ELECTRON SPIN RESONANCE STUDY OF RADIATION-INDUCED SOLID-STATE POLYMERIZATION OF CONJUGATED DIENES. **Takeda, Keiji; Yoshida, Hiroshi; Hayashi, Koichiro; Okamura, Seizo (Kyoto Univ.). J. Polym. Sci., Pt. A-1, 4: 2710-13(Oct. 1966).**

The solid-state polymerization of some conjugated dienes was studied to attain a correlation between the observed free radicals in monomers polymerized at low temperatures by ionic mechanisms and the active free radicals responsible for polymerization. When isoprene, 1,3-pentadiene, and 2,3-dimethyl-1,3-butadiene were irradiated by electrons from a Van de Graaff accelerator at −196°C, free radicals were observed in solid monomers by ESR measurements. To elucidate the mechanism of the formation of trapped free radicals in irradiated solid monomers, free radicals were produced in the solid monomers at −196°C by several methods of radical reaction, as follows: by reaction with HO radicals; by reaction with $CH_3$ radicals; and by ultraviolet irradiation. The free radicals formed by the ionizing radiation were quite different from those produced by the radical reactions. The correlation between the concentration of free radicals and the conversion of polymerization is discussed. (D.H.M.)

**43326** RADIATION CROSSLINKING OF A TRANS-1,4-POLYISOPRENE IN THE LIQUID AND SOLID STATES. **Turner, D. T. (Research Triangle Inst., Durham, N. C.). J. Polym. Sci., Pt. B, 4: 717-20(Oct. 1966).**

Studies were made on gutta-percha, a trans-1,4-polyisoprene, to determine whether its physical state influences its radiation chemistry. The experiments were designed to provide information on both crosslinks and fractures and so were planned to emphasize data at high gel content. Crystals of gutta-percha in the β-form were prepared and exposed to 4 Mev electrons from a linear accelerator at a dose rate of 1 Mrad/min at 20 and 100°C. Similar experiments were carried out simultaneously with a completely soluble sample of natural rubber, a cis-1,4-polyisoprene. Results indicated that the diverse processes which may precede crosslink formation, such as ionization, free-radical cage effects, and competition between various free-radical reactions, are not influenced by the change in physical state. (J.G.B.)

**43327** SOME KINETIC FEATURES OF THE RADIATION-INDUCED POLYMERIZATION OF ETHYLENE. **Munari, S.; Russo, S. (Univ., Genoa. Centro Nazionale di Chimica delle Macromolecole, Genoa). J. Polym. Sci., Pt. B, 4: 733-7(Oct. 1966).**

In order to confirm previously reported results on the kinetics of the radioinduced polymerization of ethylene, new experiments were carried out at very low radiation doses. Experimental evidence showed that there exists, in the plot of yields against time, an initial constant slope, followed by an autoaccelerating process. Molecular weight determinations and post-effect studies supported the application of stationary-state kinetics. The preformed polymer was found to be responsible for autoacceleration. This effect is mainly due to the formation of relatively long-life active centers on the polymer by irradiation, and causes a remarkable increase in yield. Spectral studies confirmed the short lifetime of growing chains during the polymerization of ethylene. (J.G.B.)

**43328** EXPERIENCE ON A 2 Mev VAN DE GRAAFF ACCELERATOR IN RADIATION-CHEMICAL WORKS. **Heinrich, H.-J.; Wuckel, L. (Forschungsgemeinschaft, Deutsche Akademie der Wissenschaften zu Berlin, Dresden). Kernenergie, 9: 198-203(June 1966). (In German).**

After a brief description of the Van de Graaff accelerator, the measurements of absorbed dose, the effect of the electron range, and the distribution of dose depth in irradiation of high polymers are described. Some possibilities of moving the samples within the inhomogeneous electron-beam fan are discussed as well as the heating of the samples in the case of high dose rates. Finally, some applications of the accelerator in radiation chemistry are discussed. (auth)

**43329** EFFECTS OF ADMIXTURES ON THE RADIOLYSIS OF POTASSIUM NITRATE. **Boldyrev, V. V.; Lykhin, V. M.; Oblivantsev, A. N.; Salikhov, K. M. (Inst. of Chemical Kinetics and Combustion, Academy of Sciences, Siberian SSR. Tomsk Polytechnic Inst., USSR). Kinet. Kataliz, 7: 432-8(May-June 1966). (In Russian).**

Tabulated data on radiative yields of $NO_2^-$ as a function of the concentration of impurities in $KNO_3$ showed that additions of $Tl^+$ and small amounts of $Sr^{2+}$ and $Pb^{2+}$ increased the $NO_2^-$ yield, while large amounts of $Sr^{2+}$ and $Pb^{2+}$ reduced the yield. Additions of $SO_4^{-2}$ did not exhibit any influence on the yield of $NO_2^-$. (R.V.J.)

**43330** FORMATION OF RADICALS IN THE RADIOLYSIS OF SOLID ORGANIC COMPOUNDS. IV. RADIATION-INDUCED RADICAL YIELDS IN CERTAIN SULPHUR-CONTAINING COMPOUNDS. **Trofimov, V. I.; Chkheidze, I. I.; Belen'kii, L. I.; Buben, N. Ya. (Inst. of Chemical Physics, Academy of Sciences, USSR). Kinet. Kataliz, 7: 540-2(May-June 1966). (In Russian).**

EPR measurements were made of the yield of radicals ($G_R$) in the sulfur-containing compounds, hexylmercaptan, dihexyldisulfide, thiophenol, and thiophene and its derivatives. Correlations of $G_R$ in the above compounds, hydrocarbons, and oxygen compounds of identical structure showed that in sulfur compounds $G_R = 0.4\ ^1/_{100}$ ev, while in the saturated hydrocarbons and alcohols $G_R$ was 4 to $8\ ^1/_{100}$ ev. $G_R$ in the aromatic sulfur compounds and their derivatives was 0.03 to $0.3\ ^1/_{100}$ ev, which is identical for aromatic hydrocarbons and their derivatives. (R.V.J.)

**43331** THE MODIFICATION OF POLYAMIDE FIBERS BY ENERGETIC $^{60}Co$ $\gamma$ RADIATION. **Heger, A. (Institut fuer Technologie der Fasern, Dresden). Monatsber, Deut. Akad. Wiss. Berlin, 7: 917-23(1965). (In German).**

The effects of $^{60}Co$ $\gamma$ radiation on the properties of Polyamide 6 (Dederon-Monofil) were studied and the effect of the dose output on radioinduced modifications was determined. The stress-strain behavior of irradiated and nonirradiated fibers was compared. Measurements of the stress-strain behavior made at three months and 24 months after the irradiation showed that higher radiation doses caused a greater time variation of the stress-strain diagram. It was hypothesized that the aging process increases with radiation dose. The mechanisms causing the radioinduced variations in the stress-strain behavior are discussed. (J.S.R.)

**43332** PULSE RADIOLYSIS INVESTIGATIONS OF UNIMOLECULAR ELIMINATION REACTIONS IN FREE RADICALS PRODUCED BY OH ADDITION TO HYDROXYBENZENES. **Adams, G. E. (Mount Vernon Hospital, Northwood, Eng.); Michael, B. D.; Land, E. J. Nature, 211: 293-4(July 16, 1966).**

Pulse radiolysis studies at various concentrations of neutral solutions of p-benzhydroquinone and phenol saturated in nitrous oxide and in hydrogen peroxide showed the formation of two transient absorbing species. The transition to the species with an absorption maximum at 4250 Å was kinetically first-order under all conditions and reaction order was unaffected by dose—pulse ratio. The experimental rate constant of $4.6 \times 10^4$ $sec^{-1}$ at 20°C was independent of solute concentration but showed a small temperature coefficient. An activation energy of 4.2 kcal $M^{-1}$ was obtained. The reaction became very rapid at values of pH on either side of neutrality indicating a strong acid-base catalysis. Second-order transient species disappeared by second-order kinetics but the absolute rate was slower in neutral solution compared with that at pH 2. Salt effect studies demonstrated that the species decaying in neutral solution carried a unit charge consistent with its assignment to the anion of the benzsemiquinone radical. These results suggest that elimination of water accounts for the decay of most if not all of the OH adduct radicals formed. (P.C.S.)

**43333** LIQUID-PHASE RADIATION-INDUCED CARBOXYLATION OF HYDROCARBONS WITH CARBON DIOXIDE. **Kalyazin, E. P.; Perfil'ev, Yu. D.; Bakh, N. A.;**

Nesmeyanov, An. N. (Moscow State Univ.). Neftekhimiya, 6: 582-6(July-Aug. 1966). (In Russian).

Liquid-phase carboxylation products of hydrocarbons with carbon dioxide were studied using purified n-pentane. Acids formed in liquid-phase γ- and x-radiocarboxylation of n-pentane showed the presence of $C_2$ to $C_{11}$ homologs. Complex ethers associated with acids contained only radicals with five-carbon atoms. Carbonyl compounds formed in n-pentane–$CO_2$ mixtures were limited to $C_5H_{11}CHO$ and $(C_5H_{11})_2$ CO. (R.V.J.)

**43334** THE CHEMICAL EFFECTS ASSOCIATED WITH THE (n,γ) AND (n,2n) REACTIONS IN BENZENE SOLUTIONS OF ETHYLBROMIDE AND BROMOBENZENE. Shiokawa, Takanobu; Sato, Toshiro; Kondo, Kenjiro; Sato, Kojix (Tohoku Univ., Sendai). Nippon Kagaku Zasshi, 87: 922-5(Sept. 1966). (In Japanese).

The organic yields resulting from (n,γ) and (n,2n) reactions in the mixtures of benzene and ethyl bromide or bromobenzene were estimated. The data indicated that even in benzene solution the high-energy reaction yields, obtained by the extrapolation to zero mole fraction in the scavenger curves with molecular bromine, are the same in both nuclear reactions as in a single reactant of ethyl bromide or bromobenzene. The thermal reaction yields in the (n,2n) reaction are apparently higher than those in the (n,γ) reaction. These results suggest that the high energy reaction yields are independent of the initial states of recoil bromine atoms, which may be different with the type of nuclear reaction. From comparison of thermal reaction yields, it is considered that the ratios of the number of organic radicals to inorganic ones produced in the slowing-down processes of recoil atoms are affected by the initial kinetic energies of recoil atoms. The recombination reactions in the high-energy range can be explained by the "impact model" proposed by Estrup and Wolfgang, and extended to liquid bromides by Milman. (auth)

**43335** PRIMARY PROCESSES IN RADIATION CHEMISTRY AS STUDIED BY MASS SPECTROMETRY. VII. MECHANISM OF TETRAHYDRONAPHTHALENE RADIOLYSIS IN LIQUID PHASE. Wincel, Henryk; Kecki, Zbigniew; Stachowicz, Waclaw; Minc, Stefan (Inst. of Nuclear Research, Warsaw). Nukleonika, 11: 307-17 (1966).

The mechanism of 1, 2, 3, 4-tetrahydronaphthalene radiolysis in the liquid phase developed on the basis of the recognized elementary radiation-chemical processes is discussed. The calculated yields of molecular products formed as a result of individual elementary processes and their total yields were tabulated. The calculated results were critically compared with experimental data considering the gamma radiolysis of tetrahydronaphthalene. (auth)

**43336** RADIATION-THERMAL CRACKING OF LOW-OCTANE NUMBER STRAIGHT-RUN GASOLINE IN A UNIFORM TEMPERATURE FIELD. Polak, L. S.; Glazunov, P. Ya.; Glushnev, V. E.; Ryabchikova, G. G. Petrol. Chem. (USSR) (Engl. Transl.), 5: No. 2, 134-9(1966).

Experiments were carried out with 800-kev electrons on radiation-thermal cracking of low-octane number, straight-run gasoline with a final boiling point of 140°C in a reactor having a uniform temperature distribution. A beam of electrons was introduced through the Be foil of the inlet aperture of the reactor. Temperatures used were 500, 550, and 600°C and the flow rate was 150 ml/hr. The composition and yields of products from radiation-thermal and thermal cracking of straight-run gasoline in reactors with uniform and nonuniform temperature distributions are shown. The curves plotted from these data showed that in radiation-thermal cracking in a reactor the effective process temperature was lower than the nominal value. Experiments carried out in a reactor with a uniform temperature distribution made it possible to establish the actual degree of conversion corresponding to the process temperature for a given raw material. The degrees of conversion obtained were far from optimum. Effective activation energies of thermal and radiation-thermal cracking processes calculated from the experimental data were 60 and 24 kcal/mole, respectively. When uniform temperature distribution was used for radiation-thermal cracking, complete reproducibility of experimental results and a steady yield of gaseous reaction products were achieved for the temperatures and doses studied. (BBB)

**43337** ELECTRIFICATON OF POLYETHYLENE AND POLYSTYRENE AFTER γ IRRADIATION. Asch, M. G.; Felix, M. C.; Ongaro, M. R. (Faculte des Sciences, Lyon). Phys. Status Solidi, 17: 49-57(1966). (In French).

After exposure to γ radiation, polyethylene and polystyrene acquired a stable surface electrification under the effect of an electric field. The surface charge density was calculated by assuming that the electrification is due to the displacement of electrons which, initially trapped, are progressively liberated by thermal excitation. The expression of the charge density thus obtained was compared with experimental results. (tr-auth)

**43338** STUDIES ON RADIATION-INDUCED IONIC POLYMERIZATION. III. POLYMERIZATION OF STYRENE AT ROOM TEMPERATURE. Ueno, K.; Hayashi, K.; Okamura, S. (Kyoto Univ.). Polymer, 7: 431-49(Sept. 1966).

Radioinduced polymerization of styrene in an extremely dry system was studied at room temperature. Sodium–potassium alloy was used as a drying agent. Kinetic results were very different from those previously reported in which the radical reaction was predominant. A radical mechanism is precluded in a dry system for the following reasons: addition of water and ammonia caused a reduction in the rate of polymerization ($R_p$); activation energy for $R_p$ was nearly zero between –20 and +80°C; and $R_p$ was proportional to (dose rate)$^{0.8 \text{ to } 1.0}$, while the molecular weight was independent of dose rate. Copolymerizations of styrene with α-methylstyrene and with isobutyl vinyl ether were carried out and the results strongly support a cationic mechanism. This conclusion is also verified by the retardation of $R_p$ by added ammonia and diethyl ether. Radical scavengers such as DPPH and oxygen also retarded the polymerization, so the existence of an ion-radical in the initiation step is supposed for the effect of above-mentioned scavengers. In an extremely dry system, $G_{(\text{apparent initiation})}$ is found to have a high value which may be attributed to a frequent monomer chain transfer. The polymerization mechanism based on free ions is described in detail. (auth)

**43339** STUDIES ON RADIATION-INDUCED IONIC POLYMERIZATION. IV. POLYMERIZATION OF STYRENE IN SOLUTION AT ROOM TEMPERATURE. Ueno, K.; Hayashi, K.; Okamura, S. (Kyoto Univ.). Polymer, 7: 451-8(Sept. 1966).

The radioinduced polymerization of styrene in an extremely dry system was studied in methylene chloride and toluene solution at room temperature. Under conditions of rigorous drying, far higher G(–m) values were obtained in comparison with those of normal conditions. Molecular weights of polystyrene formed in methylene chloride are higher than those obtained in bulk polymerization, which suggests strong confirmation of a cationic mechanism. Polystyrene obtained in methylene chloride at 10°C contained less than 0.3 chlorine atoms for each polymer molecule. In polymerization in toluene, the molecular weights of polystyrene decreased with increase of solvent concentration; this can be explained by chain transfer to toluene. (auth)

**43340** CHEMICAL REACTIONS OF NUCLEAR RECOIL ATOMS IN BROMOPENTAMMINE RHODIUM(III)NITRATE AND CHLOROPENTAMMINE IRIDIUM(III)CHLORIDE. Schmidt, G. B. (Univ., Cologne). Radiochim. Acta, 5: 178-80(June 1966). (In German).

The compounds $[Rh(NH_3)_5Br](NO_3)_2$ and $[Ir(NH_3)_5Cl]Cl_2$ were irradiated in a thermal neutron flux of $10^{12}$ n/cm$^2$ sec. The chemical reactions of the nuclear recoil atoms were investigated. Paper electrophoretic separations were made of the $^{82}$Br and $^{192}$Ir nuclear recoil products. At least 6 $^{82}$Br complex compounds were separated. Approximately

69% of the recoil Br was found as $Br^-$. The complexes formed could not be definitely identified. The consequences of the $^{80m}Br$ nuclear isomeric transition were considered. In the paper electrophoretic separation of the $^{192}Ir$ nuclear recoil products, seven different products were detected. Approximately 34% of the $^{192}Ir$ activity remained probably as the oxydehydrate. (J.S.R.)

**43341** RADIOLYSIS OF ACETYLENE IN SOLUTION. IV. THE ACTION OF $\gamma$ RADIATION ON AQUEOUS SOLUTIONS OF ACETYLENE; RADIOLYSIS IN THE ABSENCE OF AIR AND THE INFLUENCE OF CONCENTRATION. Fiti, Maria; Tudor, Lucia (Institut de Physique Atomique, Bucharest). Rev. Roum. Chim., 11: 761-6(June 1966). (In French).

The action of $^{60}Co$ $\gamma$ radiation on an aqueous solution of acetylene, in the absence of air, and variation of G values of the processes of oxidation and radiolytic polymerization of acetylene as a function of the concentration of the acetylene and of the oxygen, were studied. The proper experimental conditions to govern the radiolytic processes were determined and a mechanism of the reactions to explain the results was proposed. The work contributes new proofs to confirm some of the hypotheses of radiation chemistry of aqueous solutions. (tr-auth)

**43342** INFLUENCE OF $\gamma$-RADIATION ON THE PHYSICO-CHEMICAL PROPERTIES OF LINEAR SATURATED ALIPHATIC POLYESTERS. PART I. ADIPIC ACID POLYESTERS. Orszagh, A.; Gorska-Bulhak, Z. (Inst. of Nuclear Research, Warsaw). Rocz. Chem., 40: 849-55 (1966). (In Polish).

The effect of $\gamma$ rays on the change of solubility and of the intrinsic viscosity of polyesters of adipic acid was investigated. (auth)

**43343** INFLUENCE OF $\gamma$-RADIATION ON THE PHYSICO-CHEMICAL PROPERTIES OF LINEAR SATURATED ALIPHATIC POLYESTERS. PART II. POLYESTERS OF SEBACIC, ASELAIC, AND GLUTARIC ACIDS. Orszagh, A.; Gorska-Bulhak, Z. (Inst. of Nuclear Research, Warsaw). Rocz. Chem., 40: 857-61(1966). (In Polish).

The modifying effect of $\gamma$ rays on linear aliphatic saturated polyesters was investigated. The polyesters are degraded, when irradiated in the presence of air; they show an increase of intrinsic viscosity in nitrogen atmosphere, and yield insoluble gels at higher radiation doses. The value of a gel-dose depends on the number of methylene-groups in the monomer unit and on the molecular mass of the polyester. The polysebacates with an even number of methylene groups in the monomer unit, require a lower radiation dose for cross-linking than the corresponding polyadipates. (auth)

**43344** RESTORATION OF PHOTOGRAPHS BY NEUTRON ACTIVATION. **Ostroff, Eugene (Smithsonian Inst., Washington, D. C.). Science, 154: 119-23(Oct. 7, 1966).**

Talbots' techniques of producing photographic negatives and positive paper prints are reviewed with emphasis on image degradation problems. Restoration of badly faded or stained photographs by use of neutron activation and autoradiography was considered. It was shown to be possible if at least a trace of image silver is present and if the picture is relatively free of halogens and other silver. The degree of intensification was controlled by balancing the initial level of activation and the duration of autoradiographic contact. (M.C.G.)

**43345** RADIOLYSIS OF DODECYL MERCAPTAN. Panchvidze, M. V.; Chirakadze, G. G.; Nanobashvili, E. M. (Inst. of Inorganic and Electrochemistry, Academy of Sciences, Georgian SSR). Soobshch. Akad. Nauk Gruz. SSR, 43: 75-81(July 1966). (In Russian).

The radioinduced transformation of normal and tertiary dodecyl mercaptan, $C_{12}H_{25}SH$, by itself and dissolved in *iso*-octane and benzene was investigated, using a $^{60}Co$ source and evaluating the effects by means of an electrometric method and by infrared spectroscopy. The results indicated that the compound is oxidized to disulfide, thiosulfone, and sulfo peroxide, even if only $5 \times 10^{19}$ erg ev/ml of energy is absorbed. In an *iso*-octane solution, the degree of transformation was found to be a direct function of the concentration. The yield of the solution did not exceed 2.7 mol/ev. This value was lower in a benzene solution of the compound because of the higher radiation resistance of benzene. There were indications that a chain reaction mechanism may be induced in the radiolysis. (TTT)

**43346** GRAFTING TO CELLULOSE AND ITS DERIVATIVES. **Stannett, Vivian (Research Triangle Inst., Durham, N. C.). Tappi, 47: 58A; 68A; 78A(Mar. 1964).**

Various chemical and radiation methods for grafting synthetic polymers to cellulose and its derivatives are reviewed, and comments are made regarding the limitations of some of these methods. The importance of the techniques of grafting used, in addition to the choice of monomer and the amount grafted, is discussed. The establishment of proof that grafting does occur is discussed, and solubility and density gradient centrifugation evidence is presented. The grafted celluloses undoubtedly contain large amounts of ungrafted cellulose and homopolymer. This can lead to disappointing properties compared with those of isolated graft copolymers. Relatively few property studies are reported, particularly on products substantially freed from the homopolymers. However, some results were published concerning the properties of grafted wood, cellulosic textile fibers, and paper. The known effects of grafting on the properties of paper are discussed. (BBB)

**43347** ELECTRON AND $\gamma$-RAY INDUCED ADDITION OF FORMAMIDE TO OLEFINS. Rokach, Joshua; Krauch, Carl Heinrich (Max-Planck-Institut fuer Kohlenforschung, Muelheim-Ruhr, Ger.). Tetrahedron Lett., No. 28, 3253-7 (July 1966).

It was found that formamide adds to olefins in an electron- or $\gamma$-induced reaction. By adjusting the experimental conditions it was possible to obtain 1:1 adducts in yields up to 80%. The general reaction is as follows: $RCH = CHR' + HCONH_2 \rightarrow RCH_2-CHR'CONH_2$. A list of the 10 olefins used, products, chemical yields, and G values are presented in tabular form. Most of the reactions yielded comparable results with 2-Mev electron and $^{60}Co$ $\gamma$ irradiation. A stepwise mechanism for the reaction is proposed. Evidence for the existence of a carbamoyl radical was obtained. In electron radiation experiments, oxamide and alkylsuccinamides were isolated. Due to higher LET, the concentration of the carbamoyl radicals is higher than with the $^{60}Co$ source, in which these by-products could not be detected. Oxamide presumably results from the dimerization of the $-CONH_2$ radical. (BBB)

**43348** RADIATION-INDUCED INTERACTION OF ACRYLONITRILE WITH CYANOETHYLATED COTTON. **Demint, Robert J.; Arthur, Jett C. Jr.; McSherry, Wilbur F. (Southern Regional Research Lab., New Orleans). Textile Res. J., 31: 821-4(Sept. 1961).**

The radioinduced interaction of acrylonitrile with cyanoethylated cotton and the properties of the modified cotton were studied. The effect of degree of substitution (DS) on the radioinduced interaction and on the properties of the product was examined. With an increase in DS from about 9 to 1.3, the amount of monomer interacted with the yarn increased about fourfold; elongation-at-break and yarn number increased; average stiffness decreased markedly; and breaking strength and toughness decreased slightly. Maximum interaction occurred at doses from about 0.8 to 1.5 MR. Physical properties of the products are reported. The relation between the interaction of monomer with cyanoethylated cotton and degree of substitution at a dose of 1 MR was also studied. Interacted monomer per 100 units of cellulose increased linearly over a range from 0.0 to about 1.0 DS and then increased rapidly. There were about 3 groups added by radioinduced interaction per cyanoethyl group. The immediate elastic recovery of the yarns indicated the absence of cross-links or possibly the presence of cross-links having very weak bonds. It was concluded that the radioinduced interaction probably involves grafting of side chains of acrylonitrile at the site of the cyanoethyl groups. (BBB)

**43349** RADIATION-INDUCED INTERACTION OF STYRENE WITH COTTON. **Demint, Robert J.; Arthur, Jett C. Jr.; Markezich, Anthony R.; McSherry, Wilbur F. (Southern Regional Research Lab., New Orleans). Textile Res. J., 32: 918-22(Nov. 1962).**

The indirect effects of radiation-excited cotton, in the presence of methanol and N,N-dimethylformamide, on the efficiency of activation and interaction of styrene with fibrous cotton cellulose was studied. On irradiation of a solution of styrene (70%) and methanol (30%) in which cotton cellulose was immersed, the initial rate of polymerization was about three times the rate in the absence of cellulose, indicating that the presence of radiation-excited cellulose increased the rate of free radical formation of styrene, and consequently the rate of polymerization of styrene. As the relative concentration of styrene to cotton was increased, the amount of styrene interacting with cotton cellulose increased to a weight ratio of about 3.5 : 1 styrene : cotton. The effects of radiation dose on polymeric weight gain and related yarn number, breaking strength, resistance to wetting, resistance to degradation by acids, and solubility are summarized. The electron micrographs indicated that the polymer is located within the growth layers of the fiber and is grafted to the cellulose. Stiffness and resiliency data indicate that the products containing radiation-interacted polystyrene are thermoplastic. A chain reaction was indicated by the high radiochemical yields obtained. (BBB)

**43350** GENERAL CORRELATION OF E.S.R. DATA FOR F-CENTERS. IDENTIFICATION OF AN F-CENTER IN SODIUM CYANIDE. Claxton, T. A.; Greenslade, D. J.; Root, K. D. J.; Symons, M. C. R. (Univ., Leicester, Eng.). Trans. Faraday Soc., 62: 2050-6(Aug. 1966).

One of the paramagnetic centers formed in $\gamma$-irradiated sodium cyanide gives rise to a multi-component ESR spectrum, which is assigned to an F-center. Justification for this is based on an empirical correlation connecting the apparent spin density of the F-electron on the six nearest cations, with a function of the lattice parameter and the atom radii of the cations. Possible implications of this correlation are discussed. (auth)

**43351** ORIGIN OF PRIMARY HYDROGEN ATOM YIELD IN RADIOLYSIS OF AQUEOUS SOLUTIONS. Chouraqui, M.; Sutton, J. (CEN, Saclay, France). Trans. Faraday Soc., 62: 2111-20(Aug. 1966).

Studies of the competitive scavenging of "primary hydrogen atoms" by the nitrate ion and organic solutes showed that the yield of these atoms decreases in a similar way to the molecular hydrogen yield as the nitrate concentration increases. It was concluded that a reaction of the hydrated electron in the regions of high ionization density (spurs) such as $e_s^- + H_3O^+ \rightarrow H$ could be largely responsible for the appearance of the "primary hydrogen atom" yield. (auth)

**43352** H/D ISOTOPE EFFECTS IN THE FORMATION OF HYDROGEN FROM THE COMBINATION OF TWO RADICALS IN AQUEOUS SOLUTIONS. Anbar, M.; Meyerstein, D. (Weizmann Inst. of Science, Rehovoth, Israel. Soreq Nuclear Research Center, Rehovoth, Israel). Trans. Faraday Soc., 62: 2121-31(Aug. 1966).

The H/D isotope effects of the reactions $e_{aq}^- + e_{aq}^-$ (a), $e_{aq}^- + H$(b) and H + H (c), were determined using high-intensity pulse radiolysis. At room temperature in mixtures of $H_2O + D_2O = 1:1$, the following H/D isotope effects were observed: $\alpha_a = 4.7 \pm 0.2$, $\alpha_b = 1.5$ to $1.9 \pm 0.3$ (depending on the pH) and $\alpha_c = 2.6$ to $3.5 \pm 0.2$ (depending on the pH). The isotope effect of the "molecular" hydrogen formed in the radiolysis of water, $a_M = 2.2 \pm 0.1$, was found to be independent of pH. In view of the isotope effects, reaction (a) was interpreted in terms of the formation of a $(e_{aq}^-)_2$ center as an intermediate, and reaction (b) as involving the formation of a hydride ion. The results indicate that the "molecular" and the "residual" hydrogen, produced in neutral radiolyzed aqueous solution, are formed via reactions different from those assumed in the diffusion model for the radiolysis of water. Most probably these species are formed from excited water molecules. The incompatibility of the results with the diffusion model makes a revision of the latter most desirable. (auth)

**43353** ALTERATION OF ORGANIC LACQUER FILMS BY ELECTRON IRRADIATION. von Ardenne, M.; Neumann, M. (Forschungsinstitut Manfred von Ardenne, Dresden). Z. Angew. Phys., 21: 196-200(1966). (In German).

A description is given of experimental lacquer film masks obtained by lacquer cross linking caused by electron irradiation. Results show that the used collodion lacquer becomes permeable to etchants when the optimum charge density for cross linking is exceeded. Permeability caused by this decomposition is also utilized for making lacquer masks. Subsequent examinations show that there exists a maximum permeability for a definite charge density. Growing contamination layers, however, tend to reduce permeability when this optimum charge density is exceeded. (auth)

**43354** IMPORTANCE OF ELECTRON AND ION RECOMBINATIONS DURING RADIATION OXIDATION OF NITROGEN. Dmitriev, M. T. (Moscow Inst. of Hydrometeorological Instrumentation). Zh. Fiz. Khim., 40: 1511-15(July 1966). (In Russian).

At irradiation doses of less than 10 MR/sec the concentration of negative ions in the N–O system at atmospheric pressure significantly exceeds the concentration of free electrons. With increase of pressure from 1 to 150 atm the ratio increases. The adhesion coefficient in O is $0.7 \times 10^{-14}$ cm$^3$/sec and the recombination coefficient in N–O is 0.06 – 1.6 cm$^2$/sec depending on the pressure. At pressures of 1 to 150 atm in the N–O system, the recombination of oppositely charged ions plays a negative role in the radiation oxidation of N, decreasing the energy level of the reaction. (tr-auth)

**43355** THE EFFECT OF PROTECTING COMPONENTS ON RADIATION CHEMICAL REACTIONS OF POLYMER MOLECULES. Heusinger, H. Munich, Technical Univ., 1965. 66p. $2.00 Gmelin, AED-Diss. 65-326.

Thesis.

Radiation resistance of polystyrene (with addition of a molecular solution of pyrene) and polystyrene-acrylonitrile copolymers was studied. Pyrene gave a very effective protective action for radical production which can be explained by energy transfer. Maximum protective action occurred for low pyrene concentrations (3%). In the copolymer the styrene component had a protective effect on the acrylonitrile component which was caused by intramolecular energy transfer. (Gmelin Inst.)

**43356** PROCEEDINGS OF THE NUCLEAR AND RADIATION CHEMISTRY SYMPOSIUM, WALTAIR, INDIA, JANUARY 20–22, 1966. Bombay, Department of Atomic Energy, 1966. 362p. (CONF-660115).

Sixty-six papers were presented at the symposium. They covered various aspects of the subject such as separation and estimation, complex formation, spectroscopy, radiolysis, labeling, and biological materials. Separate abstracts were prepared for 52 of the papers given in this volume. (P.C.S.)

*For abstracts of individual papers see: 42726, 43129–43136, 43243–43252, 43357–43367, 43396–43403, 43442–43448, 43532–43534, 43974, and 44815–44817.*

**43357** RADIOLYSIS OF AQUEOUS SOLUTIONS. Rao, K. V. S. Rama; Srinivasan, Kamala; Shastri, L. V. (Atomic Energy Establishment, Trombay, India). pp 109-18 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Reactivity of H atoms with cyclohexane in the liquid phase was studied. Radiolysis of water was used as the source of H atoms and the hydrogen yields at varying concentrations of copper sulfate and cyclohexane were subjected to a kinetic analysis. Experiments were also carried out in the presence of air and pertinent results are tabulated. Organic peroxide was formed at the expense of hydrogen peroxide by a reaction between $C_6H_{11}O_2^-$ and $O_2^-$ radicals. $HO_2^-$ radicals seemed unreactive towards $C_6H_{11}O_2^-$

radicals. At any intermediate pH, $O_2^-$ radical concentration was determined by $HO_2 \rightleftharpoons H^+ + O_2^-$ equilibrium. The selective reaction between an alkyl peroxy radical and $O_2^-$ radical was used to establish the above equilibrium. It was suggested that the concept of hot hydrogen atoms may need to be retested using the rate constant derived from the high reactivity of cyclohexane with H atoms in liquid phase. (P.C.S.)

**43358** GAMMA RADIOLYSIS OF PLUTONIUM SOLUTIONS IN 0.8N SULPHURIC ACID. Mazumdar, A. S. Ghosh; Natarajan, P. R.; Srinivasan, B. (Atomic Energy Establishment, Trombay, India). pp 119-27 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The radiolysis of Pu(III) solutions was studied to estimate the yields of various products and to relate them to the yields of the primary radiolytic products of water. Gamma irradiation of 0.001$\underline{M}$ Pu(III) solution in 0.8$\underline{N}$ $H_2SO_4$ yielded Pu(IV) and $H_2O_2$ at doses to $0.169 \times 10^{19}$ ev/ml. Yields increased slowly with time; higher doses gave less variation. Experiments with pure Pu(IV), to ascertain if it could be oxidized to Pu(VI) or reduced to Pu(III), produced negative results with doses up to $1.43 \times 10^{19}$ ev/ml; however considerable $H_2O_2$ was produced. Irradiations in presence of argon also yielded Pu(IV) and $H_2O_2$, but a lower yield of Pu(III) was noted. Within the limits of experimental error the yield of hydrogen remained practically constant. Possible oxidation reactions are noted and discussed. (P.C.S.)

**43359** GAMMA RADIOLYSIS OF THE ISOMERS OF ETHYL TOLUENE. Rao, M. R. (Atomic Energy Establishment, Trombay, India). pp 128-33 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The effects of temperature, scavenger, and the integrated dose on the γ-radiolysis of ethyl toluenes were studied. The yields of $H_2$ and $CH_4$ were linear with dose in the range studied, $2.5 \times 10^6$ to $2.5 \times 10^7$ rads. The gas yields, 0 to 150°C, indicated that the meta isomer was the most stable toward radiation. The yield of $C_2H_2$ was much less than that of either $C_2H_6$ or $C_2H_4$, indicating very little ring rupture. The H yield was unaffected by the free radical scavenger ($O_2$) but methane yield was reduced to ⅓ of the original. Ethane and ethylene were assumed to be formed by $C_2H_5$ abstracting H atom from some other molecule or by losing an atom to some other fragment. The relative radiation stability was in the order of m > p > o. (P.C.S.)

**43360** RADIATION INDUCED CIS-TRANS ISOMERIZATION OF STILBENE IN HYDROCARBON SOLUTION. [PART] I. Srivastava, S. B. (Atomic Energy Establishment, Trombay, India). pp 134-40 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Investigations were carried out on the triplet state produced in the radiolysis of benzene, using triplet-initiated isomerization of stilbene. In cyclohexane solution after irradiation, isomerization was about ⅔ less than in benzene in the solute range from 0.001 to 0.1$\underline{M}$. The triplet state of benzene, possibly the donor species, was produced with a G value of 6.8 in the radiolysis of benzene. A complete cessation of such transitions was observed when radiation-sensitized isomerization was carried out at −196°C. Arguments are presented against the $^1B_{2u}$ state. (P.C.S.)

**43361** RADIATION INDUCED REACTIONS INVOLVING CYCLOHEXANE AND CYCLOHEXENE. Rao, K. Narayana; Ramanan, G. (Atomic Energy Establishment, Trombay, India). pp 141-5 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Typical addition reactions to the double bond under radiation were studied using cyclohexene and cyclohexane irradiated at 0°C by measuring the synthesis of methylcyclohexylketone (MCHK) by gas chromatography. When cyclohexane and acetyl chloride were irradiated together, the MCHK yield was dependent on the composition of the mixture. Acetone irradiated with cyclohexane also gave the acetyl radical; decreased yield in the presence of air indicated free radicals were involved. Cyclohexene, when irradiated with acetylchloride, gave a dark polymeric material difficult to analyze, but cyclohexene−acetylchloride−cyclohexane gave good yields. Addition of the acetyl radical to cyclohexane (acetaldehyde) gave better MCHK yields than the acetyl radical reaction with cyclohexane alone. In all the compounds reacted with cyclohexene the α-bond to the C=O was broken to give $CH_3CO$ radical; so ethyl formate was irradiated with cyclohexene and the cyclohexane carboxylic ester was analyzed by gas-liquid chromatography. A maximum G value appeared at 75% cyclohexene by weight (24.4) at 30°C. Temperature variations (−78, 0, 15, 30, and 50°C) effected no change in yield but at a dose rate of $1.16 \times 10^5$ rads/hr gave a maximum G-value of 34.1. (P.C.S.)

**43362** KINETICS OF ANNEALING OF GAMMA-IRRADIATION DAMAGE IN POTASSIUM BROMATE. Khare, Mohan; Mohanty, S. R. (Banaras Hindu Univ., India). pp 151-6 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Isothermal annealing of γ-irradiated potassium bromate was studied at 50-Mrad doses and the oxidizing fragments varied from 1600 to 1658 ppM. The concentration of the fragments diminished with time when heated, at first rapidly and then slowly. As much as 0.51% of the damage was annealed by 50-hr heating at 150°C. The energy of activation for the first order process was 3.3 kcal $mole^{-1}$ and that for the second order process 11.7 kcal $mole^{-1}$. (P.C.S.)

**43363** THERMAL DECOMPOSITION OF IRRADIATED THORIUM OXALATE. Mohanty, S. R.; Ray, M. N. (Banaras Hindu Univ., India). pp 157-62 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The influence of γ-radiation on the kinetics of thermal decomposition of thorium oxalate dihydrate was studied from 335 to 400°C. A light grey coloration and some gas evolution were noted. The chemical damage produced by a 100-Mrad dose was 5.2 ion %. The length of the linear stage diminished with temperature and was virtually absent at the highest temperature used. Activation energy was 35.4 kcal $mole^{-1}$ for the unirradiated, and 30.1 kcal for the irradiated oxalate. (P.C.S.)

**43364** EFFECT OF RADIATION ON THE CATALYTIC BEHAVIOUR OF SOME TRANSITION METAL OXIDES. Venkateswarlu, K. S.; Virmani, Y. P. (Atomic Energy Establishment, Trombay, India). pp 163-70 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

The kinetics of decomposition of $H_2O_2$ on unirradiated and reactor-irradiated oxide samples, and those irradiated and subsequently thermally annealed were studied for $Cr_2O_3$, CuO, $MnO_2$, NiO, and ZnO. The activation energies were in the order MnO < NiO < ZnO < $Cr_2O_3$ and followed the same pattern as in catalytic decomposition of nitrous oxide at these metal oxide surfaces. In no case did thermal annealing restore all radiation damage although some improvement was noted. Analysis of a similar study using rare earth oxides, $Dy_2O_3$, $Er_2O_3$, $Gd_2O_3$, $La_2O_3$, $Nd_2O_3$, $Pr_6O_{11}$, and $Sm_2O_3$, showed a large compensation effect and only a small change in free energy. The relation of magnetic susceptibility to catalytic activity was more fully brought out by rare earth oxides. The level of radioactivity had no positive influence on the decomposition reaction with $Nd_2O_3$ and $Sm_2O_3$. ESR spectra before and after reactor irradiation confirmed that specific conductivity change occurred with irradiation of $La_2O_3$. A more complex spectra was observed for irradiated $Nd_2O_3$ (only at liquid air temperatures) indicating free electrons with nuclear spins. Experiments were also run for a heterogeneous decomposition of $D_2O_2$ at a few oxide surfaces and for $H_2O_2$ decomposition at a NiO surface under irradiation in the d-d region (~730 μ) for nickel. These experiments established the migration of a proton and desorption of oxygen as intermediate steps. Radiation effects were concluded to be due to the generation of donor impurities affecting the Fermi level of the oxides and partly due to radiation damage of the surface. (P.C.S.)

**43365** EFFECT OF REACTOR RADIATIONS ON THE FLUORESCENCE SPECTRUM OF $RbUO_2(NO_3)_3$. Asundi, R. K.; Dixit, R. M. (Atomic Energy Establishment, Trombay, India). pp 171-5 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Irradiation of $RbUO_2(NO_3)_3$ after 10 hr showed that a portion of the salt was converted to $Rb_2UO_2(NO_3)_4$. The 20-hr irradiation period showed continuous emission between 5600 and 6200 Å. Observed results were similar to those for $CsUO_2(NO_3)_3$. (P.C.S.)

**43366** SOME STUDIES ON THE ANNEALING BEHAVIOUR OF NEUTRON-IRRADIATED TRIS-DIPYRIDYL Co(III) PERCHLORATE IN THE HYDRATED FORM. Vaish, S. P.; Nath, Amar; Shankar, J. (Atomic Energy Establishment, Trombay, India). pp 176-83 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Two sets of irradiations were carried out using different samples of the trihydrate at 30°C: hydrated, stored in dry ice; hydrated, stored at room temperature for 20 hr; and hydrated, stored at room temperature for 4 days. Unheated samples were compared with samples heated at 120 and 150°C before irradiation. Results showed that prior thermal treatment enhanced the rate of annealing. (P.C.S.)

**43367** USE OF CHARGED PLATES IN THE (n,γ) RADIOLYSIS OF BROMO AND IODO COMPOUNDS. PART V. Arnikar, H. J.; Dedgaonkar, V. G. (Univ. of Poona). pp 274-81 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Organic halogen compounds were studied using a photoneutron source, 13-C $^{124}Sb-Be$ (flux = $10^7$ n/cm$^{-2}$/sec$^{-1}$), in which the neutrons were thermalized by ~40-cm enclosure of paraffin. The systems studied were $CH_3I$, $C_2H_5I$, $C_6H_5I$, $C_2H_5Br$, and $C_6H_5Br$. These were irradiated for varying periods and for periods corresponding to the saturation of the $^{128}I$ in the iodo and $^{80}Br$ in the bromo compounds. Results are reported. A preliminary study of the change in the conductivity due to radiolysis showed a 10 to 25% increase in the conductivity under similar conditions with a maximum in ethyl bromide and ethyl iodide, which have relatively higher dielectric constants. (P.C.S.)

**43368** ARGON SENSITIZED RADIOLYSIS OF LIQUID PROPANE. Koob, R. D.; Kevan, Larry (Univ. of Kansas, Lawrence). 4p. (CONF-660419-1). ORAU. Gmelin, AED-CONF-66-057-1.

From IEEE Region 6 Annual Conference, Tucson, Ariz.

Solutions of Ar and other rare gases with propane were exposed to gamma radiation from $^{60}Co$ source. Both $O_2$-scavenged and unscavenged systems were investigated. G-values of individual products of the radiolysis of the mixture are reported and show striking characteristics resulting from energy transfer from Ar to propane. With the addition of small amounts of Ar, yields of ethane and methane from the radiolysis of propane increased dramatically and selectively; however, this selectivity was noted only for the argon–propane mixtures. In the xenon–propane mixtures, energy transfer was indicated by enhancement of all product yields. The fact that oxygen-scavenged argon–propane mixtures still exhibited large yields suggested that the products arose via ionic or excited molecule reactions. The following reactions occurring efficiently in the liquid are suggested as reaction possibilities: $C_2H_5^+ + C_3H_8 \rightarrow C_2H_6 + C_3H_7^+$ and $C_3H_8 \rightarrow C_2H_4^+ + CH_4$. If these reactions are valid, the main mechanism of energy transfer must be charge exchange. (B.L.M.)

**43369** RADIOLYTIC PEROXIDATION OF P-XYLENE. Bradley, R. F.; Roth, J. A. (Vanderbilt Univ., Nashville, Tenn.). 13p. (CONF-660320-11). ORAU. Gmelin, AED-CONF-66-051-32.

From American Chemical Society, 151st Meeting, Pittsburgh.

The effects of radiation energy, dose rate, and temperature on the radiolysis peroxidation of p-xylene were investigated. The x-ray source for the investigations consisted of a pulsed beam at 120 cps with a peak voltage of 50kv and a constant potential source operating up to 150kv. The radiation supplies the energy to break the primary hydrogen bond in p-xylene producing free radicals and hydrogen atoms. As a result of the reaction of free radicals, p-xylene hydroperoxide and $H_2O_2$ are produced. The rate of peroxide formation at various dose rates is reported, and models are derived for the total rate of peroxide formation. The peroxide formation rate as related to temperature was also investigated. (B.L.M.)

**43370** CHEMICAL NATURE OF THE REACTIVE SPECIES PRODUCED IN POLYMERS BY IONIZING RADIATIONS. Chapiro, Adolphe (CNRS, Bellevue, France). 17p. (CONF-660320-4). ORAU. Gmelin, AED-CONF-66-051-5.

From American Chemical Society, 151st Meeting, Pittsburgh.

Three types of reactive species are formed under irradiation and may become trapped in polymers. These are: ionic species, radicals, and peroxides. Very little information is available on the role played by ions in chemical transformations occurring in irradiated polymers. The presence of long-lasting ions is demonstrated by radioinduced conductivity and these may become involved in some of the post-irradiation effects. The presence of trapped radicals is well established in irradiated polymers, but a number of problems are yet unsolved with respect to their fate and particularly to the migration of free valencies. Stable peroxides are produced whenever polymers are irradiated in the presence of oxygen. Depending on experimental conditions hydroperoxides or diperoxides arise in the process. Both radicals and peroxides can initiate post-irradiation grafting and the various active centers lead to different kinetic features. Experimental data are presented and reaction mechanisms are discussed. (auth)

**43371** CROSS-LINKING OF POLYVINYLIDENE FLUORIDE BY GAMMA RADIATION. Sands, George D.; Pezdirtz, George F. (Langley Research Center, Hampton, Va.). 6p. (CONF-650902-32). ORAU. Gmelin, AED-CONF-65-235-73.

From American Chemical Society, 150th National Meeting, Atlantic City.

Studies of the tensile strength, elongation, and solubility of γ-irradiated samples of polyvinylidene fluoride film indicated crosslinking of the polymers rather than the expected chain scissor behavior. This behavior is associated with the small size of the fluorine atoms which are not crowded together to produce strain and hence do not cause rupture. (B.L.M.)

**43372** REACTION RATES AND PHYSICAL PROPERTIES IN THE RADIATION GRAFT-COPOLYMER SYSTEM: POLYVINYL CHLORIDE–STYRENE. Harmer, David E. (Dow Chemical Co., Midland, Mich.). 19p. (CONF-660320-9). ORAU. Gmelin, AED-CONF-66-051-23.

From American Chemical Society, 151st Meeting, Pittsburgh.

The polyvinyl chloride-styrene graft-copolymer system was investigated under gamma irradiation from a $^{60}Co$ source for a semi-rigid gel-phase mixture of the two components containing from 9 to 23% styrene. The glassy transition temperature had to be approached very closely in order to facilitate diffusion within the system sufficiently to effect maximum conversion of the monomer. Expressions for the amount of conversion during irradiation and during heat treatment after irradiation are combined to give an expression for the overall degree of conversion for a given radiation dose. The mechanism of the termination step of the process appears to vary with styrene concentration. After completion of the graft copolymerization of the system, the amount of homopolymer present and certain physical properties of the copolymers were investigated. The total amount of homopolymer present, calculated as 1.99% of the total copolymer, indicated a high degree of graft copolymerization. Studies of density and tensile and flexural strengths presented in graphic form indicate that these properties are generally better for the copolymer than for the pure polyvinyl chloride and that they display well-defined maxima at styrene concentrations of 10 to 20%. (B.L.M.)

**43373** SZILARD-CHALMERS EFFECTS IN SOLID XENON COMPOUNDS. Margraff, R.; Adloff, J. P. (Centre de Recherches Nucleaires, Strasbourg). 11p. (CONF-660431-3). ORAU. Gmelin, AED-CONF-66-120-3.

From Symposium on Hot Atom Chemistry, Lafayette, Ind.

The behavior of solid xenon fluorides was investigated in relation to isotopes that arise from in-pile irradiation of natural xenon, separation of free xenon from the fluorides and determination of the nature of the bound xenon (physical and chemical retention) after irradiation. An unexpectedly high fraction of radioxenon remained chemically bound after the irradiation. The retention was nearly quantitative in the tetrafluoride and quite independent of irradiation time and neutron flux in the limits investigated. The chemical nature of the retained radioxenon was elucidated from the results of the hydrolysis reactions of the different fluorides. The retention of the radioxenon in an irradiated perxenate salt is also discussed. (B.L.M.)

**43374** RECENT RESULTS ON THE γ-RADIATION-INDUCED POLYMERIZATION OF SOME VINYL MONOMERS IN EMULSION SYSTEMS. Ley, Gregor J. M.; Hummel, Dieter O.; Schneider, Christel (Cologne Univ.). 31p. (CONF-660320-8). ORAU. Gmelin, AED-CONF-66-051-25.

From American Chemical Society, 151st Meeting, Pittsburgh.

A sensitive recording dilatometer is described for the study of the overall reaction rate of the γ-radiation induced emulsion polymerization of a number of vinyl monomers. Absolute maximum reaction rates as well as rates relative to styrene are reported for methacrylonitrile, acrylonitrile, vinylidene chloride, chloroprene, methyl, ethyl, and decyl methacrylates. Isoprene emulsions did not polymerize, even with irradiation doses of up to $10^5$ R/hr. In all cases, sodium dodecyl sulfate was used as an emulsifier. Rate-time functions of the monomers are shown in graphical form, and the behavior of the various systems is discussed. (B.L.M.)

**43375** RADIATION CROSS-LINKING OF POLYOXYETHYLENEGLYCOL IN AERATED AQUEOUS SOLUTION. Marchal, Jean; Crouzet, Claude; Decker, Christian (Centre de Recherches sur les Macromolecules, Strasbourg). 9p. (CONF-660320-7). ORAU. Gmelin, AED-CONF-66-051-1.

From American Chemical Society, 151st Meeting, Pittsburgh.

The radioinduced crosslinking of polyoxyethyleneglycol was easily obtained in degassed or aerated aqueous solutions. The roles of the various parameters, radiation dose rate, pH, and polymer concentration of solutions for given ratio of the free surface to the volume of solution and oxygen pressure (the partial pressure of oxygen in air), were studied at 25°C. (auth)

**43376** THE EFFECT OF IONIZING RADIATION ON ETHYLENE-ALKYL ACRYLATE COPOLYMERS. Potts, J. E.; Purcell, C. L.; Clinard, O. J. (Union Carbide Corp., Bound Brook, N. J.). 14p. (CONF-660320-14). ORAU. Gmelin, AED-CONF-66-051-50.

From American Chemical Society, 151st Meeting, Pittsburgh.

Ionizing radiation crosslinks ethylene-alkyl acrylate copolymers, and as a result increases tensile strength, impact strength, and stress crack resistance, and permits the product to be used above the crystalline melting point in certain applications. Pre-formed tubing after crosslinking, is readily oriented to give clear, glossy, strong, heat-shrinkable film. Copolymers containing above 15% acrylate, loaded with carbon black and crosslinked, are flexible over a wide temperature range. Copolymers containing above 25% acrylate exhibit the properties of rubber gum stock and can be crosslinked to give elastic products having the low permanent set characteristics of vulcanized rubber. (auth)

**43377** TRACK EFFECTS IN RADIATION-INDUCED CHEMICAL REACTIONS. Faw, R. E.; Miller, L. F. (Kansas State Univ., Manhattan). 24p. (CONF-660210-2). ORAU. Gmelin, AED-CONF-66-006-4.

From American Inst. of Chemical Engineers 58th National Meeting, Dallas.

A systematic computational procedure is described for analyzing the kinetics of chemical reactions induced by ionizing radiation. The results thus obtained for a simple sequence of reactions are compared to those obtained using homogeneous kinetics calculations. On the basis of slowing-down spectra of charged particles characteristic of fast-neutron irradiation of water, chemical yields are computed and compared with yields for irradiation by gamma rays. (auth)

**43378** RADIATION CHEMISTRY OF POLYETHYLENE TEREPHTHALATE. Turner, D. T. (Research Triangle Inst., Durham, N. C.). 18p. (CONF-660320-12). ORAU. Gmelin, AED-CONF-66-051-36.

From American Chemical Society, 151st Meeting, Pittsburgh.

Two aspects of the radiation chemistry of polyethylene terephthalate (PET) are reviewed: the dependence of yields of products on radiation dose and on dose rate. The chemical structure of PET is outlined, and the nature of the unstable species formed during gamma irradiation are discussed. The irradiation in vacuo by gamma irradiation or electrons caused the PET to become yellow and brittle with crosslinking and fracturing of the macromolecules to produce the gaseous products $CO_2$, CO, $H_2$, and $CH_4$. The initial G-values for the gaseous products at a dose rate of $10^{-2}$ Mrad/min were found to be: $-COOH = 0.8$, $CO_2 = 0.17$, $CO = 0.11$, $H_2 = 0.015$, and $CH_4 = 0.003$. The yield of $H_2$ and other gaseous products was virtually independent of dose rate; however, the yield of the carboxyl group decreased while the ratio of crosslinks to fractures increased with increasing dose rate. Electron spin resonance studies showed that at a dose rate of $10^{-3}$ Mrad/min the G (trapped radical) value was 0.02, and the predominant free radical was identified as $-CO-O-\dot{C}H-CH_2-O-CO-$. This free radical is invoked to explain the formation of carboxyl groups by a chain reaction which would be sensitive to dose rate, and a suggested reaction is written. (B.L.M.)

**43379** METHOD OF POLYMERIZING VINYL ETHERS. Atchison, George J.; Narlock, Raymond M. (to Dow Chemical Co.). U. S. Patent 3,264,203. Aug. 2, 1966. Filed Apr. 10, 1963.

A process is described for polymerizing a vinyl ether by subjecting the ether in contact with $SO_2$ to the action of high-energy ionizing radiation in a field having an intensity of at least 10,000 rads/hr. The vinyl ether is preferably an aliphatic vinyl ether or a mixture of two or more vinyl alkyl ethers. (B.L.M.)

# Radiochemistry

## *See also* Separation Processes and Procedures

**43380** (ORNL-P-2432) SECONDARY STANDARDIZATIONS USING DIGITAL COMPUTER TECHNIQUES TO NORMALIZE MULTIPLE GAMMA-RAY SPECTRA FOR DIRECT EFFICIENCY DETERMINATIONS. Eldridge, J. S. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 14p. (CONF-661012-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From IAEA Symposium on the Standardization of Radionuclides, Vienna, Austria.

A library of statistically tested gamma spectra has been collected for absolutely assayed sources of 42 radionuclides. Techniques for use of the library data in a direct assay method as well as a computer system of gamma spectral resolution have been developed. It has been shown that secondary standardizations of radionuclides may be performed with this library with accuracies of 1–5%. A single nuclide standard used in conjunction with the library data permits a rapid determination of radioactive source strength in many spectrometer systems. (auth)

**43381** (ORNL-P-2433) STANDARDIZATION OF $^{197}$Hg. Eldridge, J. S. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 23p. (CONF-661012-2). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From IAEA Symposium on the Standardization of Radionuclides, Vienna, Austria.

Mercury-197 was prepared by several different routes and various parameters affecting the assay of the nuclide were studied. The use of enriched $^{196}$Hg targets effectively eliminated $^{203}$Hg contamination. It was found that techniques of $X_K$-$\gamma$ coincidence counting or singles counting using a branching ratio of 1.03 photons (68–77 kev) per disintegration can yield absolute disintegration rates with accuracies 5%. Half life determinations yielded values of 23.8 ± 0.1 and 64.14 ± 0.05 hr for the two $^{197}$Hg isomers. (P.C.H.)

**43382** MASS SPECTROMETRY OF BIOSYNTHETICALLY LABELED RICININE. Waller, George R. (Karolinska Institutet, Stockholm); Ryhage, Ragnar; Meyerson, Seymour. Anal. Biochem., 16: 277-86(Aug. 1966).

Mass spectral measurements on ricinine samples biosynthetically labeled in various positions established what parts of the ricinine molecule are retained in the fragment ion. This in turn was used to determine the position of incorporation in ricinine of nitrogen administered as formamide-$^{15}$N. Independent confirmation was obtained by chemically degrading the labeled ricinine to 4-methoxy-N-methyl-2-pyridone and measuring label retention in this product. Ricinine isolated 12 hr after injection of the formamide contained the label only in the ring. After 24 hr, the label was found in both the ring and the nitrile group in proportions of about 3:1. (P.C.H.)

**43383** PREPARATION OF $^{233}$Pa TRACER. Sill, Claude W. (Atomic Energy Commission, Idaho Falls, Idaho). Anal. Chem., 38: 1458-63(Oct. 1966).

Three procedures were developed for preparation of $^{233}$Pa tracer. One procedure employs extraction with diisobutylcarbinol to separate the protactinium from irradiated thorium. The other two procedures involve milking the $^{233}$Pa from a solution of its long-lived $^{237}$Np parent, employing either diisobutylcarbinol extraction or precipitation on barium sulfate. The procedures are simpler and more convenient and overall recovery of tracer is about 98%. Sulfuric acid and sodium sulfate are used to dissolve the protactinium and keep it in solution. Solutions are stable for long periods of time and can be re-extracted or reprecipitated without repeating other preparatory treatment. Erratic behavior generally attributed to protactinium was not observed. The procedures contribute to the fundamental chemistry of protactinium and are directly applicable to the radiochemical determination of both $^{231}$Pa and $^{233}$Pa. (auth)

**43384** RADIOACTIVE SOURCE OF SOFT X RADIATION FOR PHYSICAL INVESTIGATIONS, TECHNOLOGY, AND MEDICINE. Danilin, L. D.; Lobov, S. I.; Pavlova-Verevkina, A. I.; Zukerman, V. A. At. Energ. (USSR), 21: 112-16(Aug. 1966). (In Russian).

Characteristics and preparation methods for the developing radiation sources using $^{55}$Fe are described. Uses of the soft x radiation from the isotope for investigations of atomic structure, microradiography, and medical purposes are discussed. (R.V.J.)

**43385** THE ACTIVATION OF TITANIUM DIOXIDE AS A DECONTAMINANT FOR RADIOACTIVE CONTAMINATION. Takami, Toshiko; Sasaki, Tsunetaka (Tokyo Metropolitan Univ.). Bull. Chem. Soc. Jap., 39: 1850-4 (Sept. 1966).

The decontamination efficiencies of treated and untreated titanium dioxide pastes were measured using $^{60}$Co-contaminated surfaces of polyvinyl chloride. The titanium dioxides used were commercial titanium dioxide, hydrous titanium dioxide, titanium dioxide treated with sulfuric acid, and "Titanium Cake," an intermediate product of the titanium dioxide industry. Among these titanium dioxide decontaminants, titanium dioxide treated with sulfuric acid proved most effective in decontamination, even in neutral conditions, if activated properly. The optimum condition of activation was the 50% sulfuric acid treatment of commercial titanium dioxide at 50°C for 6 hr. (auth)

**43386** PREPARATION OF ROSE BENGAL-$^{131}$I AND THE TESTING OF ITS PURITY. Raban, P.; Gregora, V. (Charles Univ., Prague). Cesk. Farm., 15: 134-8(Mar. 1966). (In Czech).

Labeling of Rose Bengal with $^{131}$I by ion exchange was carried out. Paper chromatography showed that commercial preparations differ in quality. Inorganic $^{131}$I was determined by measuring the radioactivity of the solution remaining after precipitation and centrifuging of Rose Bengal. The amount of inorganic iodine increased during the storage of the material. (JPRS)

**43387** THE ELECTROSTATIC COLLECTION OF THORIUM A. Dubois, Emmanuel; Roche, Jean; Dubois, Claude (Univ., Paris, Clermont-Ferrand, France). Compt. Rend., Ser. B, 263: 83-4(July 4, 1966). (In French).

A study was made to determine if the $\beta$ radiation emitted by the decay products of polonium-216 collected electrostatically would depend on the nature of the electrode. The curve $N = f(Z)$ where N represents the mean counting rate per minute was traced for 19 elements. The results show a significant curvature at the level of the intermediate elements at $Z = 47$. It was hypothesized that the variation of N with Z was caused by backscattering. (J.S.R.)

**43388** PREPARATION OF $^{131}$I LABELED HIPPURAN. Elekes, Istvan; Koritsanszky, Denes (Hungarian Academy of Sciences, Budapest). Gyogyszereszet, 10: No. 2, 65-6 (1966). (In Hungarian).

A solution of $^{131}$NaI is added to o-iodohippuric acid dissolved in absolute ethanol. The system is refluxed, cooled, transferred to an Amberlite IR 4B resin column, and washed with ethanol which is removed by distillation. The resulting solution of $^{131}$I-labeled hippuran with a specific activity of 70-4 $\mu$C/mg, is sealed in ampules and sterilized in steam. The compound may be used for human diagnostic studies. (J.G.B.)

**43389** PRODUCTION OF CARRIER-FREE $^{32}$P. Mani, R. S.; Majali, A. B. (Atomic Energy Establishment Trombay, Bombay). Indian J. Chem., 4: 391-2(Sept. 1966).

A method is described for the production of carrier-free $^{32}$P free from heavy metal and carbonaceous impurities, for use in medicine. Specially purified sulfur was irradiated in the reactor and the $^{32}$P extracted out by distilling off the sulfur under vacuum in a simple retort type distillation unit. The carrier-free $H_3{}^{32}PO_4$ was purified by ion exchange and then treated with specially purified activated charcoal to remove carbonaceous impurities. (auth)

**43390** ALBUMIN MACROAGGREGATES LABELLED WITH $^{99m}$Tc. De Paoli, T. (Univ., Buenos Aires); Hager, A.; Nicolini, J. O.; Radicella, R. Int. J. Appl. Radiat. Isotop., 17: 551-4(Sept. 1966).

A method for preparing $^{99m}$Tc-labeled macroaggregates of denatured human serum albumin with a particle size suitable for scintillation scanning of the lungs is described. $^{99m}TcO_4^-$ was reduced with hydrochloric acid and ammonium thiocyanate. A protein precipitate, which retained more than 95% of the $^{99m}$Tc, was formed when the solution of reduced technetium was added to human serum albumin. The precipitate was dissolved in saline solution, then autoclaved to form the albumin aggregates. The size of the particles, as determined by microscopy, was approximately 2$\mu$; the particles were grouped in clumps of sizes from 5 to 80$\mu$

dia. These aggregates were localized mainly in the lungs, as shown by distribution tests carried out in rats and by scintillation scannings of rabbits and dogs after intravenous injection of the preparations. (J.G.B.)

**43391** CRACKING OF CUMENE OVER RADIOACTIVE TRICALCIUM PHOSPHATE CATALYST. Balandin, A. A.; Dobrosel'skaya, N. P. (Inst. of Physical Chemistry, Academy of Sciences, USSR. Moscow State Univ.). Izv. Akad. Nauk SSSR, Ser. Khim., 12: 2095-2100(1965). (In Russian).

The effect of radioactive tricalcium phosphate catalyst, containing the isotopes $^{45}Ca$ and $^{32}P$, on cracking reactions for cumene was investigated. The cumene cracking reaction on radioactive tricalcium phosphate catalyst is not accelerated in comparison with the non-radioactive catalyst. The radioactivity of the catalyst containing 87 mC/g does not affect the character and number of acid centers of tricalcium phosphate determined by the method of waterless titration with n-butylamine solutions. The specific surfaces of the radioactive and non-radioactive catalyst prepared under similar conditions, differed insignificantly. New data on the use of the heterolytic mechanism for the cumene cracking reaction on tricalcium phosphate catalyst are reported. (tr-auth)

**43392** ORGANOMETALLIC EXCHANGE REACTIONS. II. $^7Li$ AND PROTON NUCLEAR MAGNETIC RESONANCE SPECTRA OF ALKYLLITHIUM AND LITHIUM TETRAALKYLMETALATE SOLUTIONS IN ETHER. Williams, K. C.; Brown, Theodore L. (Univ. of Illinois, Urbana). J. Amer. Chem. Soc., 88: 4134-40(Sept. 20, 1966).

The $^1H$ and $^7Li$ NMR spectra of ether solutions of the following mixtures were examined in the temperature range +30 to –60°: $LiCH_3-LiB(CH_3)_4$, $LiCH_3-LiAl(CH_3)_4$, $LiAl(CH_3)_4-LiB(CH_3)_4$, $Al(CH_3)_3-LiAl(CH_3)_4$, $Al(CH_3)_3-LiB(CH_3)_4$, $LiC_2H_5-LiAl(C_2H_5)_4$, $LiC_2H_5-LiGa(C_2H_5)_4$, $LiAl(C_2H_5)_4-LiGa(C_2H_5)_4$. In addition the $^7Li$ and $^1H$ spectra of the pure components in ether were also obtained. Alkyl group exchange is slow on the NMR time scale in all mixed systems except for $Al(CH_3)_3-LiAl(CH_3)_4$. The rate-determining process in this system appears to be formation of solvent-separated ion pairs from contact ion pairs: $Li^+,Al(CH_3)_4^- \rightarrow Li^+||Al(CH_3)_4^-$. The Arrhenius activation energy is estimated to be 9.1 ± 1 kcal/mole. $^7Li$ exchange obeys the same kinetics in the $LiCH_3-LiAl(CH_3)_4$ and $LiCH_3-LiB(CH_3)_4$ systems. The rate-determining step appears to be dissociation of the methyllithium tetramer: $(LiCH_3)_4 \rightarrow 2(LiCH_3)_2$. The Arrhenius activation energy is estimated, as an average value for the two systems studied, to be 11.2 ± 1 kcal/mole. $^7Li$ exchange in the $LiMR_4-LiM'R_4$ systems is rapid at the lowest temperature studied, about –57°. The mechanism probably involves bimolecular interaction of the two lithium-bearing species, with facile exchange of $Li^+$. (auth)

**43393** ORGANOMETALLIC EXCHANGE REACTIONS. III. $^7Li$ AND PROTON NUCLEAR MAGNETIC RESONANCE SPECTRA OF METHYLLITHIUM–DIMETHYLMAGNESIUM AND METHYLLITHIUM–DIMETHYLZINC IN ETHER. Seitz, Larry M.; Brown, Theodore L. (Univ. of Illinois, Urbana). J. Amer. Chem. Soc., 88: 4140-7(Sept. 20, 1966).

Proton and $^7Li$ nuclear magnetic resonance spectra of ether solutions of methyllithium with dimethylmagnesium and dimethylzinc have been examined over a range of temperatures. The spectra show that complex species of the form $Li_2M(CH_3)_4$ and $Li_3M(CH_3)_5$ (M = Zn or Mg) are formed. No 1:1 complex is observed. Exchange of $^7Li$ between $LiCH_3$ and complex appears to occur at about the same rate and with the same activation energy, as methyl-group exchange. The exchange processes are faster in the zinc than in the magnesium system. It appears that in the zinc system the rate-determining process is dissociation of methyllithium tetramer to dimers. Exchange of methyl groups between $Mg(CH_3)_2$ and $Li_2Mg(CH_3)_4$ is quite rapid, despite a comparatively high activation energy, 15 kcal/mole. The analogous exchange is rapid in the zinc system at –107°C, the lowest temperature studied. (auth)

**43394** ISOTOPE FRACTIONATION OF METHYL ESTERS BY GAS–LIQUID CHROMATOGRAPHY. Sgoutas, Demetrios S. (Univ. of Illinois, Urbana). Nature, 211: 296-7(July 16, 1966).

Methyl esters of stearic, oleic, and linoleic acids labeled with both tritium and carbon-14 were chromatographed to determine isotope effect. Results demonstrated that gas-liquid chromatography, utilizing commonly used columns, has sufficient resolving power to segregate isotopic molecules that differ less than 2% in mass. (P.C.S.)

**43395** ELECTROLYTIC CELL FOR RADIOACTIVE ISOTOPES. Zhetbaev, A. K.; Kaipov, D. K.; Smirin, L. N.; Tyshchenko, A. P. (Inst. of Nuclear Physics, Alma-Ata, USSR). Prib. Tekh. Eksp., No. 3, 209-10(May-June 1966). (In Russian).

A design for an electrolytic cell is described. The U-tube houses a Pt anode and terminates with a stainless steel cathode; the solenoid produces a pulsating magnetic field for stirring the electrolyte. The radioisotope is deposited on the substrate. The cell was used for preparing Moessbauer $^{57}Co$ sources; electrolyte composition and other data are reported. (ATD)

**43396** PREPARATION OF THIN UNIFORM TARGETS OF ACTINIDE ELEMENTS. Rajagopalan, M.; Ramaniah, M. V. (Atomic Energy Establishment, Trombay, India). pp 65-71 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Preparation of target sources of actinium, americium, neptunium, and uranium was studied. Methods are described for deposition by electrolysis on both aqueous and nonaqueous mediums. Data of the effectiveness of butyl, ethyl, and isopropyl alcohols as solvents for neptunium are given for deposition on aluminum, platinum, and stainless steel. (P.C.S.)

**43397** PREPARATION OF SOME SPECIAL RADIOISOTOPE LABELLED COMPOUNDS AT TROMBAY. Iya, V. K.; Mani, R. S.; Desai, C. N.; (and others) (Atomic Energy Establishment, Trombay, India). pp 218-22 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Methods were developed at Trombay for the preparation of radio-iodinated human serum albumin; $^{131}I$-labeled Rose Bengal, Cholographin, Diodrast, and Hippuran; radio-iodinated Bromosulfalein; radio-iodinated fats and azo-dyes; organic mercurials for medical use; and $^{32}P$-labeled insecticides, Malathion and Parathion. (P.C.S.)

**43398** PREPARATION OF SOME USEFUL RADIOISOTOPES OF HIGH SPECIFIC ACTIVITY. Iya, V. K.; Mani, R. S.; Ballany, A. K. (Atomic Energy Establishment, Trombay, India). pp 223-8 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Methods were developed for the production of carrier-free $^{35}S$, $^{54}Mn$, $^{58}Co$, $^{113}Sn$, $^{125}Sb$, and $^{131}Cs$. The possibility of enhancing the specific activity of $^{36}Cl$, $^{45}Ca$, $^{55}Fe$, and $^{133}Ba$ by recirculating the irradiated targets was discussed. (P.C.S.)

**43399** RECENT IMPROVEMENTS IN THE CHEMICAL PROCESSING METHODS FOR RADIOISOTOPES. Murthy, T. S. (Atomic Energy Establishment, Trombay, India). pp 229-35 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Methods are given for the separation of $^{131}I$, $^{32}P$, and $^{198}Au$ as examples of the emphasis placed on the ease and simplicity of preparation, dependent on purity and product desired by the customer. (P.C.S.)

**43400** PREPARATION OF $^{204}Tl$ SOURCES FROM IRRADIATED THALLIUM METAL. Murthy, T. S.; Balasubramaniam, K. R.; Rajagopalan, R. (Atomic Energy Establishment, Trombay, India). pp 236-43 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Irradiated thallium metal was electrodeposited on thin copper foils using active thallous sulfate solutions. Minute amounts of $H_2O_2$, used to speed the reactions, interfered with the deposition. At higher current densities black crystalline deposits were obtained, which did not adhere well to the copper foil. The optimum current density required for uniform and non-removable deposits was 0.83 mA/$cm^2$ with an efficiency of about 75%. The prepared thallium sources were coated with cadmium, gold, and silver and the effects of each on the physical properties of the source were noted at temperatures ranging from 300 to 500°C. (P.C.S.)

**43401** PREPARATION OF $^{51}$Cr OF HIGH SPECIFIC ACTIVITY FOR MEDICAL USE. Iya, V. K.; Mani, R. S.; Chowdhary, S. Y. (Atomic Energy Establishment, Trombay, India). pp 244-9 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Experiments were performed for the preparation of pure $^{51}$Cr of high specific activity by recoil enrichment using potassium chromate, ammonium chromate, and chromium acetyl acetonate as targets. Methods based on carrier precipitation, solvent extraction, ion exchange, direct precipitation, and precipitation on a column of alumina were studied. Potassium chromate with an optimum irradiation of 3 to 6 days at a neutron flux of (50 to 150) × $10^{11}$ n/$cm^2$/sec in the self serve positions in CIRUS gave a product of specific activity > 100 C/g, suitable for medical use. (P.C.S.)

**43402** PHOTOSYNTHESIS OF $^{14}$C LABELLED SUGARS. Viswanathan, K. V.; Srinivasan, A. R.; Muralidharan, B. (Atomic Energy Establishment, Trombay, India). pp 291-6 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A simple, economical, routine-production procedure using canna Indica was developed for the separation of sugars in a photosynthetic chamber. Many solvent systems were tried with little success. Several circular paper chromatograms were run using solvent systems wherein either ethanol, propanol, n-butanol, isobutanol, or n-hexanol formed the polar component and the nonpolar component was either petroleum ether, n-hexane, n-heptane, or benzene in various proportions. A 1 : 1 n-butanol : n-hexane mixture gave a good separation between fructose, glucose, and sucrose, the $R_f$ values being respectively, 0.27, 0.17, and 0.07. As much as 250 mg of a mixture of fructose, glucose, and sucrose in equal proportions could be separated on a single chromatogram with only 100 ml of solvent with a specific activity of 79%. (P.C.S.)

**43403** TAGGING OF HIPPURAN WITH RADIOIODINE ($^{131}$I). Joshi, G. C.; Singh, Bikram; Zutshi, D. N.; Chakraborty, K. P. (Ministry of Defence, Delhi). pp 303-9 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Experiments were carried out to establish a suitable method for preparing hippuran-$^{131}$I by various oxidizing agents, and by varying the quantities of $^{131}$I used. Use of oxidizing agents gave better exchange than without any oxidizing agent. Of the three oxidizing agents used, both $H_2O_2$ and $KIO_3$ gave better results than $NaNO_2$. $H_2O_2$ was preferred over $KIO_3$ as it decreased the specific activity of $^{131}$I by 1/6. Experimental results with different quantities of $^{131}$I showed that an increase of 15-fold of $^{131}$I-activity in the reaction mixture did not alter the percent of exchange. Differing amounts of hippuran showed that the percent of $^{131}$I-exchange decreased appreciably when <0.1 mg of hippuran was used. The advantages of this method are the small amount of radioactivity handled and that it does not require remote handling nor any shielding arrangement. (P.C.S.)

**43404** PRODUCTION OF $^{131}$I. Stevovic, Jelica; Jacimovic, Ljubodrag (Boris Kidric Inst. for Nuclear Science, Belgrade). Tehnika (Belgrade), 17: 1449-52 (1962). (In Croatian).

The properties and uses of $^{131}$I are reviewed. A method and equipment for the production of $^{131}$I are described. Telluric acid is irradiated at a flux of 8.4 × $10^{12}$ n/$cm^2$-sec for 7 to 14 days. In the final product, radioiodine is found as Na$^{131}$I in a solution containing $Na_2S_2O_3$, $Na_2CO_3$, NaOH, and isotonic phosphate buffer. (J.G.B.)

**43405** RADIOCHEMICAL DETERMINATION OF URANIUM IN ENVIRONMENTAL MEDIA BY ELECTRODEPOSITION. Levine, Harry (Public Health Service, Washington, D. C.); Lamanna, Anthony. U. S. Public Health Serv. Pub., No. 999-RH-11, 21p.(Mar. 1965).

An electrodeposition method for determining uranium is described. A regulated power source connected in parallel permits several electroplating operations to proceed simultaneously. The procedure was applied to a series of spiked solutions with reproducible results. Maximum deviation was less than 5% for any one determination. Beer's law is followed over a range of $10^{-5}$ to 5.0 g uranium. The method is applicable to samples of biological materials as well as to environmental media. (TSAT)

**43406** PAPER CHROMATOGRAPHIC STUDY ON DISTRIBUTION OF PRODUCT FORMED FROM $Ph_3$(RaD)I AFTER β-DISINTEGRATION. Wu, Chi-Lan; Chen, Chihi Yueh; Weng, Cheng-Wen; Chang, Shu-Ming. Yuan Tzu Neng, 1: 27-31(1965). (In Chinese).

Paper chromatography was used to study the distribution of the β-decay products of $^{210}$Pb-labeled triphenyl lead iodide. Effects of different developers for the filter paper were studied using $C_6H_6$, ethyl acetate, and petroleum ether. Chromatographic results were compared with values obtained by carrier extraction. No new product was noted when a $^{210}$Pb-labeled solution of $C_6H_6$−PbI was dropped on the products already formed on the filter paper. (P.C.S.)

**43407** PREPARATION AND RADIOACTIVE SYNTHESIS OF γγ DIMETHYL-ALLYL-PYROPHOSPHATE. Immel, H. Heidelberg, Univ., 1964. 68p. $2.00 Gmelin, AED-Diss. 64-1090.

Thesis.

Methods for preparation and $^{14}$C labeling of γ,γ-dimethylallyl pyrophosphate are given. Every C atom of this compound can be labeled depending on the initial labeled product for synthesis. (Gmelin Inst.)

**43408** THEORETICAL TREATMENT OF HYDROGEN ABSTRACTION BY HOT TRITIUM ATOMS. Kaufman, Joyce J. (Research Inst. for Advanced Studies, Baltimore); Harkins, Jerome J.; Koski, Walter S. 48p. (CONF-660431-2). ORAU.

From Symposium on Hot Atom Chemistry, Lafayette, Ind.

Two mechanisms are postulated to lead to hydrogen abstraction by hot tritium atoms: axial attack along a C−H bond or a stripping mode. Quantum chemical calculations of the $CH_4$−T system were undertaken with the object of determining how the overlap populations (and energies) varied as a function of C−H−T distances. The model chosen was axial attack of T along the C−$H_1$ bond direction, which leads to abstraction of the $H_1$ atom. It was found that as T approaches $H_1$, there is a position of maximum $H_1$−T overlap population at about the same place as the position of minimum C−$H_1$ overlap population. These results set certain limits on the geometric configurations that would be expected to undergo the $H_1$ abstraction reaction. The overlap populations also indicate why, in compounds containing very electronegative substituents, the abstraction reaction occurs at a lower energy than would be predicted by the simple bond energy dependence. A potential energy surface was also traced out for the $CH_4$−T reaction and a basin was found indicating a stable $CH_4T$ (or $CH_5$) molecule. Examination of activation energies calculated for axial attack compared to direct attack of H (or T) on the C atom showed clearly why at low T kinetic energies the abstraction reaction is favored over the substitution reaction. Also included is a comparative discussion of various methods for obtaining potential energy surfaces: rigorous calculations including correlation effects, diatomics-in-molecules, valence-bond calculations, and the bond order-bond energy method of Johnston. The method described is completely general and is applicable to any type of reactive collision. This includes abstraction and substitution reactions of heavier hot atoms such as C, N, Cl, and Br. (auth)

**43409** PREPARATION OF DEUTERO-HYDROCARBONS. Scott, Kenneth Thomas Bartlett; Metcalfe, Wiliam John; Grimes John Herbert; Sackman, John Frank (to United Kingdom Atomic Energy Authority). British Patent 1,038,830. Aug. 10, 1966. Filed Nov. 21, 1958.

A method is described for the preparation of deutero-acetylenes and deutero-ethylenes by passing a mixture of the unsaturated hydrocarbon and $D_2O$ in the form of steam over a reducing catalyst at an elevated temperature in the range from 100 to 250°C. The contact time between the reducing catalyst comprised of either Pd, Ni, Pt, or alloys of these metals is up to approximately 10 sec. (B.L.M.)

## Separation Processes and Procedures

***See also*** **Analytical Procedures**
**ISOTOPE TECHNOLOGY —**
**Separation and Production**

*Refer also to abstracts 43819, 43820, and 43874.*

**43410** (ANL–7137) COMPARATIVE COST STUDY OF THE PROCESSING OF OXIDE, CARBIDE, AND METAL FAST-BREEDER-REACTOR FUELS BY AQUEOUS, VOLATILITY, AND PYROCHEMICAL METHODS. Levenson, M.; Trice, V. G. Jr.; Mecham, W. J. (Argonne National Lab., Ill.). May 1966. Contract W-31-109-eng-38. 168p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

A study was made to determine the relative economic potential of the various fuel-reprocessing technologies as applied to several possible fast-reactor fuels. For each of three alternative fuel types, namely, uranium oxide–plutonium oxide, carbide, and metal, flowsheets and plant designs were specific and capital and operating costs were estimated for three alternative types of processes: aqueous solvent extraction, fluid-bed volatility, and pyrochemical. The conceptual plant components for which the costs were estimated were the processing plant, ultimate waste disposal, analytical laboratories, auxiliary facilities, out-of-reactor fuel inventory, and shipping of the spent fuel. For each of these cost centers, three sizes of processing plant were considered: an on-site plant serving one 1000-Mw(e) fast reactor; an on-site plant serving three 1000-Mw(e) reactors; and a central processing plant serving ten 1000-Mw(e) reactors. Data are tabulated. (P.C.H.)

**43411** (BNWL-SA–677) ION-EXCHANGE SEPARATION OF KILOCURIE QUANTITIES OF HIGH PURITY PROMETHIUM. Wheelwright, E. J.; Roberts, F. P.; Upson, U. L.; Kirby, L. J.; Myers, T. R. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Sept. 6, 1966. Contract AT(45-1)–1830. 28p. (CONF-660907–3). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From American Chemical Society Meeting, New York.

Optimum conditions for the purification of the individual light rare earth elements by ion exchange elution have been determined for the eluting agents EDTA, HEDTA, and DTPA. The conditions apply directly to the isolation of macro quantities of pure promethium from the fission product rare earths. DTPA was demonstrated to be superior to both EDTA and HEDTA. Operating conditions are described which allow a 4-fold reduction of both the elution time cycle and the volume of waste solution generated compared to previously reported work. Seven 9-foot high water-thermostated ion exchange columns, ranging from 8 inches to 1 inch ID, plus associated tanks, pumps, and instrumentation were installed in one of Battelle-Northwest Laboratories' Hot Cells. The technology developed during the isolation of 500,000 C of $^{147}$Pm in this equipment is summarized. (auth)

**43412** (DP–1044) DISSOLUTION OF THORIUM OXIDE. Hyder, M. Lee; Prout, William E.; Russell, Edwin R. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). July 1966. Contract AT(07-2)-1. 15p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The factors that influence the rate of dissolution of aluminum-canned irradiated $ThO_2$ were quantitatively assessed. Conditions were established that provide dissolution rates acceptable for a plant-scale process. (auth)

**43413** (EURAEC–1659) REPROCESSING OF IRRADIATED FUEL. Special Report No. 6. Goossens, W. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). [1966]. Contract 006-65-7RCIB. 43p. (EUR–2852; R–2376). Dep. mn. CFSTI $2.00 cy, $0.75 mn.

Work Performed under United States–Euratom Joint Research and Development Program.

The problems connected with the chemical decladding and gaseous reprocessing of heterogeneous fuel were investigated. It is possible in practice to effect the chemical decladding of elements canned in Zircaloy by means of HCl at 400°C. It is also possible to declad elements canned in stainless steel by means of 40% HCl in $O_2$ at 550°C, but many technical problems are involved. The gaseous reprocessing methods with a selective fluorination of uranium ($BrF_5$- or $ClF_3$ procedure) offer possibilities of industrial application with respect to their uranium part. The plutonium part of none of the known gaseous reprocessing methods holds out any prospect of industrial application at present. The conditions of plutonium subtilization are therefore being more closely investigated. An account is given of the difficulties encountered, together with a description of some technical realizations in different laboratories that were visited. (auth)

**43414** (ISO–207) CONTINUOUS URANIUM PEROXIDE PRECIPITATION. Curtis, M. H. (Isochem Inc., Richland, Wash). Apr. 1966. Contract AT(45-1)-1851. 20p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A continuous process for peroxide precipitation of uranium from nitrate solutions is described. The basis for the process is the use of acetic acid complexing and ammonium hydroxide pH adjustment prior to the peroxide precipitation. Use of this method results in low filtrate waste losses (<0.01 g of U per liter), and a slurry with excellent filtration rates. Continuous precipitation is made by blending a dilute (5%) hydrogen peroxide stream with the precipitation feed stream. Ambient temperature, vigorous agitation, and a 10 to 20 min residence time are required. (P.C.H.)

**43415** (ISO-SA–3(Rev.)) RECOVERY OF $^{233}$U FROM IRRADIATED THORIA. Rathvon, H. C.; Blasewitz, A. G.; Maher, R.; Eargle, J. C. Jr.; Wible, A. E. (Isochem Inc., Richland, Wash.). May 1966. Contract AT(45-1)–1851. 75p. (CONF-660524–19). Dep. mn. CFSTI $3.00 cy, $0.75 mn.

From 2nd International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn.

Application of the thorium–uranium separations processes to the Savannah River and Hanford facilities is described. The results of the separations campaign at Savannah River are summarized and estimates of the performance anticipated for Hanford are presented. In addition, the Hanford program for development of the thoria dissolving capability required at that site is included. Nuclear safety is also discussed. The bases for criticality control in the thorium–uranium-233 processing system at Hanford are similar to those currently used for uranium–plutonium processing. (P.C.H.)

**43416** (ISO-SA–24) MAJOR REPAIR AND MODIFICATION TECHNIQUES USED ON LARGE SCALE SEPARATION FACILITIES. Kane, J. F.; Koontz, W. H. (Isochem Inc., Richland, Wash.). July 15, 1966. Contract AT(45-1)-1851. 24p. (CONF-661001–13). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

For Presentation at 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

In the separations plants at Hanford, repairs and modifications to canyon cells have been made by remote methods, portions of cell floors replaced, concrete curbing cut out, and piping to the cells reclaimed or replaced. Radiation levels beyond the tolerable limits for personnel preclude contact work without shutdowns of facilities to perform extensive decontamination work. These plants are designed for remote replacement of the processing vessels, equipment, and interconnecting piping. This concept requires the vessel support pads, dowel pins, and trunnion guides, and wall nozzles be located within the cell to a high degree of accuracy. Various programs performed at Hanford are described. (P.C.H.)

**43417** (ISO-SA-25) REMOTE MAINTENANCE IN A LARGE SCALE SEPARATIONS PLANT. McIntosh, J. D.; Raab, G. J. (Isochem Inc., Richland, Wash.). July 15, 1966. Contract AT(45-1)-1851. 24p. (CONF-661001-16). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

For Presentation at 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

Remote maintenance in the large Purex Separations plant hot processing canyon consists almost entirely of equipment replacement. The Purex plant separates uranium, plutonium, and neptunium from Hanford irradiated metal. Original design provided for replacement of any or all equipment in the forty foot deep shielded processing cells by the versatile remote canyon cranes. Fifty-six percent of the original value of remote canyon processing vessels has been replaced for maintenance reasons during the ten year plant history. Effective use of a large inventory of precisely engineered replacement equipment has helped to hold maintenance downtime to less than ten percent. (auth)

**43418** (LA-3534) PROCESSING OF PLUTONIUM BY ION EXCHANGE. VIII. SELF-DIFFUSION STUDIES IN ANION-EXCHANGE RESIN. James, D. B.; Beyer, W. A. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). June 15, 1966. Contract W-7405-eng-36. 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The isotopic migration rate of plutonium(IV) in Dowex 1 anion-exchange resin was studied for varying temperature, nominal percent cross-linking, and fractional equilibrium loading with plutonium. The diffusion coefficient decreased very rapidly with increasing loading. A diffusional model suggested by these results is qualitatively discussed. (auth)

**43419** (LA-DC-7869) BETA DECAY OF SOME CERIUM ISOTOPES FAR TO THE NEUTRON-RICH SIDE OF STABILITY. Hoffman, D. C.; Michelsen, O. B.; Daniels, W. R. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1965]. Contract W-7405-eng-36. 21p. (CONF-660817-2). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Symposium on Why and How Should We Investigate Nuclides Far Off the Stability Line, Lysekil, Sweden.

A procedure involving column partition chromatography was devised to achieve very rapid separation of fission product cerium. This technique permits direct observation of the decay of 1.2-min $^{147}$Ce and 3.0-min $^{145}$Ce without interference from the growth of praseodymium daughter activities. Mass-free sources of $^{146}$Ce were also prepared for observations of its electron spectrum. A direct measurement of the half life of $^{147}$Ce gave 1.2 ± 0.1 min in agreement with the value of 1.1 ± 0.1 min obtained by a radiochemical milking technique. The $\beta$ and $\gamma$ radiations of $^{146}$Ce and $^{145}$Ce were studied and partial decay schemes were formulated. An interesting feature is the observation of allowed $\beta$ transitions (log ft values = 4.2–5.0) in the decay of both nuclides. Total $\beta$-decay energies of 1.10 ± 0.10 and 2.5 ± 0.2 Mev were determined for $^{146}$Ce and $^{145}$Ce, respectively. Preliminary studies indicated that the column technique used in these investigations can also be adapted for use in similar studies of other short-lived nuclides such as the fission-product molybdenum–technetium and zirconium–niobium isotopes. (auth)

**43420** (MCW-1508) LABORATORY INVESTIGATION OF RECOVERY PROCESSES FOR PITCHBLENDE RESIDUES. Hansen, J. W.; Nelson, E. N.; Sublett, T. H.; Robertson, W. J. (Mallinckrodt Chemical Works, Weldon Spring, Mo. Uranium Div.). Jan. 19, 1966. Contract W-14-108-eng-8. 15p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Several processes for recovery of the metallic values in the pitchblende residues from the Destrehan Street Refinery were investigated. The ammonia-leach process was investigated briefly, but it failed to recover sufficient material to make it attractive. Efforts then were concentrated on the use of sulfuric acid leaching. The results indicate that the proposed process developed in this study is technically feasible and that it makes possible the recovery of reasonable yields of the metallic values except the rare earths and part of the selenium. The products are obtained as three separate concentrates: copper–selenium; cobalt–nickel; and uranium–thorium–scandium. These combinations should be easy to separate into the individual values as required to obtain the optimum market value. Alternatively, they should present no abnormal storage problems once they are dried. (auth)

**43421** (NP-16216) INTEGRATED DOSE AND NEUTRON SPECTRA RESULTING FROM A CRITICALITY INCIDENT. Benfenati, I. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). June 1966. 15p. (ETR-193). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Irradiation doses from all radiation released in a criticality incident of $10^{17}$ fissions are plotted against normal concrete shield thickness. According to the results for solution systems, which are the most important in aqueous reprocessing plants, the $10^{17}$ fissions would cause a lethal dose of 800 rem in the absence of any shielding, a semilethal dose of 400 rem behind 10 cm of standard concrete and an emergency dose of 25 rem behind 45 cm of standard concrete shield. Contributions to the total dose due to prompt neutrons, primary gamma rays, and capture gamma rays are also plotted for the same shielding conditions. Spectra of neutrons leaking from critical dry and moderated systems in the absence of any shielding, and the fission product gamma dose integrated over time are represented in the form of graphs. (auth)

**43422** (ORNL-3791) PRELIMINARY DESIGN STUDY OF A CONTINUOUS FLUORINATION-VACUUM DISTILLATION SYSTEM FOR REGENERATING FUEL AND FERTILE STREAMS IN A MOLTEN SALT BREEDER REACTOR. Scott, C. D.; Carter, W. L. (Oak Ridge National Lab., Tenn.). Jan. 1966. Contract W-7405-eng-26. 128p. Dep. mn. CFSTI $4.00 cy, $1.00 mn.

A preliminary design and an engineering evaluation were made of a conceptual plant for treating the fuel and fertile streams of a molten-salt breeder reactor. The primary requirements of the process are to recover the unburned fuel ($^{233}UF_4$) and fuel-stream carrier salts (LiF–BeF$_2$) from the fuel stream, and the LiF–ThF$_4$ plus the bred $^{233}$U from the fertile stream. The plant was designed to operate continuously as an integral part of the reactor system, fitting into two relatively small cells adjacent to the reactor cell. In this study, the plant capacity is based upon treating 15 ft$^3$/day of fuel salt and 105 ft$^3$/day of fertile salt removed as side streams. These capacities are adequate for a 1000-Mw(e) power reactor. The fuel stream, is purified by fluorination and vacuum distillation. The first step removes uranium as volatile $UF_6$; the second recovers the LiF–BeF$_2$ by simultaneously volatilizing these two components from the less volatile fission products. Fortunately, the fission products so separated are primarily the rare earths, which are the most serious neutron poisons. The $UF_6$ from the fluorinator is accompanied by some volatile fission product fluorides, primarily those of Mo, Te, Ru, Zr, and Nb, which are removed by sorption on granular NaF and MgF$_2$. Finally, the $UF_6$ is reduced to $UF_4$ by hydrogen and recombined with the decontaminated LiF–BeF$_2$ carrier in a single operation. Fission products are removed from the plant by discard of NaF and $MgF_2$ sorbents and the still residue, which is a highly concentrated solution of the rare earths in LiF. Wastes are permanently stored underground. For the fertile stream, the process consists only of fluorination followed by decontamination of the $UF_6$ on NaF and $MgF_2$ sorbents. It is only necessary to remove the bred $^{233}U$ sufficiently fast to keep a low concentration in the blanket, thereby ensuring a low fission rate and negligible poisoning by fission products. Discard of the barren fertile stream at a slow rate suffices to keep the fission product concentration at a tolerable level. The chief conclusions of this study are: (1) that the fluorination-distillation process for the fuel stream and the fluorination process for the fertile stream comprise a compact and relatively simple system that can be engineered with a normal amount of developmental work, and (2) that integration of the processing plant into the reactor facility is both feasible and economical and the logical way to take advantage of the processing possibilities of a fluid-fueled reactor. The plant costs contribute about 0.2 mill/kwh to the fuel cycle cost when the reactor operates at an 80% plant factor and capital charges are amortized at 10%/year. This cost is sufficiently low to add to the incentive for developing the molten-salt breeder reactor. (D.L.C.)

**43423** (ORNL-P-2354) MASS ACTION AND NON-IDEALITY IN EXTRACTION BY AMINE SULFATE. Coleman, C. F.; Roddy, J. W. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 16p. (CONF-660805-3). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Solvent Extraction, Goteborg, Sweden.

Distribution equilibria involving alkylammonium extractants (e.g., acid and metal ion extractions, amine salt distributions) often appear to deviate significantly from the mass action law, especially in some sulfate systems. The explanation originally offered, based on assumed high aggregation of amine sulfates, was ruled out by finding that it is exceptional rather than general in benzene solutions. So far, a satisfactory general explanation of the apparent anomalies has not been found. Studies were made on tri-$\underline{n}$-octylamine and didecylamine in systems with benzene–sulfuric acid–water. At water activities 0–0.9, TOA and $(TOAH)_2SO_4$ and their mixtures are monomeric up to ~0.5 $\underline{M}$; dilute $TOAH \cdot HSO_4$ is dimeric, approaching tetrameric at ~0.5 $\underline{M}$; excess $H_2SO_4$ increases the aggregation farther. Activity coefficients $\gamma_{TOA}$ and $\gamma_{(TOAH)_2SO_4}$ decrease smoothly to 0.63 and 0.64 at 0.35 and 0.6 $\underline{M}$, respectively; $\gamma_{water}$ (for concentration expressed as $H_2O/TOAH^+$) correlates smoothly with $TOA/H_2SO_4$ ratio. The slope of log $D_U$ vs log $\underline{M}_{(TOAH)_2SO_4}$ remains near 1 as water activity is decreased from ~1 to <0.9. (auth)

**43424** (ORNL-P-2359) INTERFACE AND TRANSFERRING SPECIES IN AMINE EXTRACTION OF URANIUM. McDowell, W. J.; Coleman, C. F. (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 15p. (CONF-660805-4). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Solvent Extraction, Goteborg, Sweden.

In the extraction of uranyl sulfate by amine sulfates a question of interest is whether neutral $UO_2SO_4$ or an anion such as $UO_2(SO_4)_2^{2-}$ actually crosses the interface; this cannot be assessed by equilibrium measurements. This question and the general structure of the interface were studied by measuring interfacial tensions and the kinetics of $^{35}SO_4$ transfer between organic (di-$\underline{n}$-decylamine sulfate in benzene) and aqueous (acid sodium sulfate) phases. Interfacial tension measurements indicated the organic-aqueous interface to be saturated with a close-packed layer of the amine sulfate; sulfates oriented toward the aqueous phase. The amine sulfate-uranium complex was much less interface active. The kinetic experiments with $^{35}SO_4$ allowed detection of anionic species transfer aqueous to organic. Evidence was obtained for anion exchange when anionic species predominate in the aqueous phase and for neutral species transfer when neutral or cationic aqueous phase species predominate. (auth)

**43425** (ORNL-P-2406) PHILOSOPHY OF CHEMICAL PROCESSING EQUIPMENT DESIGN AND INSTALLATION IN THE TRANSURANIUM PROCESSING PLANT. Burch, W. D.; Peishel, F. L.; Yarbro, O. O. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 22p. (CONF-661001-19). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

The chemical processing of the alpha-active transuranic elements in the Transuranium Processing Plant (TRU), a facility that must also provide gamma and neutron shielding, has necessitated the development of unique methods of equipment fabrication and installation. These methods overcame the problems encountered in the use of hard-to-fabricate materials, such as Zircaloy and tantalum, and provided a system in which this equipment may be remotely replaced while maintaining alpha containment. All processing equipment, including the entire piping system, was shop-fabricated concurrently with the construction of the facility. The methods used will allow this equipment to be removed later and to be replaced by remote techniques. (auth)

**43426** (ORNL-TM-1650) SAND FILTRATION OF FOREIGN RESEARCH REACTOR FEED SOLUTIONS. Flanary, J. R.; Goode, J. H. (Oak Ridge National Lab., Tenn.). Sept. 28, 1966. Contract W-7405-eng-26. 6p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Laboratory tests, using feeds prepared by dissolution of prototype Foreign Research Reactor fuel elements in mercury-catalyzed nitric acid, followed by a gelatin head end treatment for silica coagulation and filtration through Ottawa sand, showed that excellent feed clarification had been obtained. Gravity filtration rates of 1 to 10 ml/min/$cm^2$ were obtained using 2 g/l of filteraid in the feed and a precoated 30-mesh sand bed. (auth)

**43427** (RL-SEP-712) SUMMARY OF $^{233}U$ STUDIES IN THE PLUTONIUM CHEMISTRY LABORATORY. Fullam, H. T. (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Sept. 8, 1965. Contract AT(45-1)-1350. 33p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Processing steps in the proposed "Z" Plant $^{233}U$ flow sheet were experimentally evaluated and the results obtained are described. Peroxide precipitation of $^{233}$ from a chloride or nitrate media is practical and the optimum pH of precipitation will depend on plant throughput, recovery capabilities, and product purity specifications. The optimum filtration rates occur at pH's of 2.0 and 3.0 for the chloride and nitrate systems, respectively. Optimum iron decontamination is obtained at precipitation pH's below 1.5 for both systems, whereas pH's greater than 2.5 are required to reduce the filtrate losses to acceptable levels. Oxide produced by peroxide precipitation is not as reactive to hydrogen reduction as ADU oxide; and as a result, the reduction time proposed in the flow sheet will probably have to be doubled. Hydrofluorination reactivity of the reduced oxide is excellent, and a reasonably low hydrofluorination temperature (≈500°C) and short residence time (15 to 30 minutes) can be used. Bomb reduction of the $^{233}U$ fluoride proceeded smoothly using the same bomb charge as is used in plutonium reduction. A yield of greater than 99 percent was obtained on the one $^{233}U$ reduction carried out. The quality of the fluoride used in the reduction is not critical, and fluoride conversions greater than 90 percent are not required. Approximately 1,250 grams of $^{233}U$ from the first Purex Plant thorium run were purified and converted to oxide by means of anion exchange and peroxide precipitation. (P.C.H.)

**43428** (RL-SEP-924) AMMONIUM DIURANATE FILTERABILITY. Curtis, M. H. (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Dec. 1965. Contract AT(45-1)-1350. 29p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Studies showed that an ammonium diuranate of desired filtration characteristics may be precipitated. A continuous precipitation at 55°C is used, with a pH of 5.0 ± 1.0 used for control. The feed may be either a uranyl nitrate or chloride solution from 0.1 to 1.25 molar in uranium, and 0.5 to 3.0 normal in acidity. A dilute ammonium hydroxide strike solution is used to facilitate control of the pH. The method results in a reduction of the level of alkali metal and alkaline earth metal impurities in the uranium by factors of from 10 to 250. (P.C.H.)

**43429** SYNTHESIS OF AMINES OF HIGH MOLECULAR WEIGHT FOR THE LIQUID-LIQUID EXTRACTION OF URANIUM. **Alonso Cermeno, F.; Lopez Aparicio, J.; Lopez Varona, J. L. (Univ., Valladolid, Spain). An. Real Soc. Espan. Fis. Quim. (Madrid), Ser. B, 62: 611-20 (Apr.-May 1966). (In Spanish).**

A series of aliphatic amines having high molecular weight were synthesized in order to be used in the extraction of uranium. (auth)

**43430** RAPID RADIOCHEMICAL SEPARATIONS OF $^{90}$Sr–$^{90}$Y AND $^{45}$Ca–$^{46}$Sc ON A CATION EXCHANGE RESIN. **Rane, A. T.; Bhatki, K. S. (Tate Inst. of Fundamental Research, Bombay). Anal. Chem., 38: 1598-1601(Oct. 1966).**

A simple rapid procedure for separating $^{90}$Sr from $^{90}$Y and for producing $^{45}$Ca from a scandium target was developed by using a cation exchange resin and dilute nitric acid. Six different concentrations of nitric acid ranging from 0.9 to 2.1 moles/l were used for the separations; 2.1$\underline{M}$ nitric acid was the optimum concentration of the acid to separate $^{90}$Sr and $^{90}$Y as well as $^{45}$Ca and $^{46}$Sc. During the milking of $^{90}$Y from $^{90}$Sr by a lactate solution, it was observed that lowering the pH from 3.05 to 2.9 increased the yield. Similar observations for $^{45}$Ca were observed when pH was lowered from 2.7 to 2.6. Results compare well with calculated values. (P.C.S.)

**43431** THE CHEMISTRY OF PROTACTINIUM. II. THE BEHAVIOR OF PENTAVALENT PROTACTINIUM IN A PERCHLORIC ACID SOLUTION. **Suzuki, Shin; Inoue, Yasushi (Tohoku Univ., Sendai). Bull. Chem. Soc. Jap., 39: 1705-15(Aug. 1966).**

Studies of the chemical behavior of protactinium(V) were carried out using the TTA–benzene extraction method, the ion exchange method, and the filtration method. When the protactinium concentration is less than $10^{-6}$ $\underline{M}$ and the perchloric acid concentration is 0.3 to 2.0 $\underline{N}$, the reaction of TTA extraction may proceed as: $PaO_m(OH)_n^{5-2m-n} + 4HT \rightleftharpoons Pa(OH)T_4 + (m + n - 1)H_2O + (5 - 2m - n)H^+$ where 2m + n is 3 and 4, or as: $PaO_m(OH)_nT^{4-2m-n} + 4HT \rightleftharpoons PaT_5 + (m + n)H_2O + (4 - 2m - n)H^+$ where 2m + n is 2 and 3. The cation exchange experiment gives results consistent with this conclusion. On the other hand, when the concentration of protactinium is higher than $10^{-6}$ $\underline{M}$, the above relation does not hold, even in the 5 $\underline{N}$ perchloric acid solution, because protactinium forms aggregates. This was confirmed by the filtration experiment. (auth)

**43432** SOLVENT EXTRACTION OF METAL IONS IN THE PRESENCE OF TWO DIFFERENT CHELATING AGENTS. **Yoshida, Hiroyuki (Japan Atomic Energy Research Inst., Ibaraki). Bull. Chem. Soc. Jap., 39: 1810-11(Aug. 1966).**

Extraction of europium and uranyl ions was studied in the presence of 2-thenoyltrifluoroacetone (TTA) and 8-quinolinol, separately and in combination. The stabilization factor was calculated for each. The distribution ratio increased greatly in the presence of two chelating agents. Both agents were able to form adduct compounds with their acid forms, which may account for the synergic effects noted. (P.C.S.)

**43433** PURIFICATION AND SEPARATION OF $^{95}$Zr AND $^{95}$Nb. **Gauthier, P.; Hilaire, M. (Centre d'Etudes Nucleaires, Saclay, France). Chim. Anal., 48: 406-10 (July 1966). (In French).**

An automatic method for the purification and separation of $^{95}$Zr and $^{95}$Nb by anion exchange resins for the purpose of preparing radioactive solutions with a known life for use as standard sources of these radioisotopes is described. (auth)

**43434** THE SOLVENT EXTRACTION OF Fe(III) AND U(VI) WITH MIXTURES OF TRI-n-OCTYLAMINE AND THENOYLTRIFLUOROACETONE IN BENZENE AND NITROBENZENE. **Nikolic, R. M.; Gal, I. J. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). Croat. Chem. Acta, 38: 17-21(1966).**

Synergic extraction for Fe(III) and U(VI) with mixtures of tri-$\underline{n}$-octylamine (TOA) and thenoyltrifluoroacetone (HTTA) is reported, with benzene and nitrobenzene as organic solvents. Enhanced extraction of Fe(III) from 0.5$\underline{M}$ HCl in benzene is attributed to the change in dielectric constant of the solvent. Enhanced extraction of U(VI) from 2$\underline{M}$ $HNO_3$ occurs in benzene and nitrobenzene. In nitrobenzene it is tentatively ascribed to the formation of a species with a molar ratio $UO_2$ /HTTA/ TOA of 1/1/1. (auth)

**43435** TECHNICAL AND ECONOMIC ASPECTS OF IRRADIATED FUELS. **Gutierrez Jodra, Luis; Lopez Perez, Baldomero; Diaz Nogueira, Eduardo (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid), 10: 205-16(May-June 1966). (In Spanish).**

The various techniques for reprocessing spent nuclear fuels are briefly outlined and their economic implications for the nuclear industry of the future are discussed. The U–Pu and the Th–$^{233}$U cycles are discussed in more detail. The possible economic influences of a widespread use of fast breeder reactors and of self-regenerating cycles are also explored. (G.O.Y.)

**43436** SEPARATION OF Ca, Ba, Sr, AND Cs USING HEATED EXCHANGE RESINS. **Cavero Grande, Bonifacio (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid), 10: 237-43(May-June 1966). (In Spanish).**

A method for separating Ba, Ca, Cs, and Sr from soil or atmospheric samples is presented. It consists basically of passing a solution of the sample through a previously heated column containing Dowex 50 resin. The Ca is then separated by dilution with 1.5$\underline{M}$ ammonium lactate; Sr and Ba are diluted together with 4$\underline{M}$ $HNO_3$, and then separated with sodium chromate. The Cs is partially retained by the column, and consequently the first outflowing liquids are retained for Cs analysis. The method presented proved to be much less cumbersome than those previously used and it lends itself more easily to standardization and more accurate reproduction. A summary of some experimental results is also given. (G.O.Y.)

**43437** PREFERENTIAL EXTRACTION OF TANTALUM FROM FLUORIDE SOLUTIONS IN TRIBUTYL PHOSPHATE-SULFURIC ACID SYSTEM. **Prasad, N. S. K.; Ranganathan, T. N.; Sastri, M. S. (Atomic Energy Establishment Trombay, Bombay). Indian J. Technol., 4: 268-71(Sept. 1966).**

Separation of niobium and tantalum by liquid-liquid extraction using tributyl phosphate as a solvent was investigated in sulfuric acid medium. The extractability of niobium and tantalum from fluoride solution was found to be dependent on sulfuric acid acidity, concentration of the aqueous phase, aqueous-organic phase ratio, and concentration of ammonium fluoride in solution. Up to 98% of tantalum is extracted with 100% TBP with 0.3$\underline{N}$ sulfuric acid in three states, while 96% of niobium is extracted with 6$\underline{N}$ sulfuric acid in six stages. All the niobium oxide and 75% of the tantalum oxide obtained are spectroscopically pure. Under these conditions high-purity tantalum oxide and niobium oxide were successfully extracted from niobite-tantalite ore. (auth)

**43438** RECOVERY OF URANIUM FROM ZIRCALOY–URANIUM ALLOY. **Jenkins, I. L.; Keen, N. J.; Robson, J. (Atomic Energy Research Establishment, Harwell, Eng.). J. Appl. Chem. (London), 17: 248-52(Aug. 1966).**

A process was studied in which Zircaloy–uranium alloy is dissolved in a mixture of hydrofluoric acid and potassium fluoride. The uranium can be precipitated with an efficiency of 99.9%, as a complex potassium uranium fluoride, together with some of the zirconium in analogous complexes. These precipitates, when dissolved in a mixture of aluminum nitrate and nitric acid, give stable solutions from which uranium may be recovered by solvent extraction with an overall efficiency of 99.7%. (auth)

**43439** USE OF TRI-ISO-OCTYLAMINE AS AN ANION EXCHANGER FOR PARTITION CHROMATOGRAPHY. Pierce, T. B.; Henry, W. M. (Atomic Energy Research Establishment, Harwell, Eng.). J. Chromatog., 23: 457-64(Aug. 1966).

A column material for partition chromatography was prepared by retaining triisooctylamine on an inert carrier. Behavior of the material was examined by batch extraction techniques, and a number of separations were performed. (auth)

**43440** EXTRACTION OF URANIUM(VI) WITH THENOYLTRIFLUOROACETONE-TRI-n-OCTYLAMINE MIXTURE. Takei, Shinsuke (Tohoku Univ., Sendai). Nippon Kagaku Zasshi, 87: 949-53(Sept. 1966). (In Japanese).

The solvent extraction of uranium(VI) from perchloric acid into a mixture of thenoyltrifluoroacetone (TTA) and trioctylamine (TOA) in benzene was investigated. The formula of the extracted species, obtained from aqueous solution of high pH value, was shown to be $UO_2(TTA)_2TOAHClO_4$ and its mixed equilibrium constant was found to be log K = 3.13. In this system no interaction was found between TTA and TOA or $TOAHClO_4$. The absorption spectrum of $UO_2(TTA)_2TOAHClO_4$ in benzene solution in the ultraviolet and visible regions resembled that of $UO_2(TTA)_2$ solution, but absorptions at near 430, 445, and 505 mμ were more distinct. Absorption of the extractant obtained from aqueous solution of low pH value at near 408 mμ shifted to the shorter wave length side when the pH of the aqueous solution was lowered. (auth)

**43441** INVESTIGATIONS ON THE POSSIBILITY OF REDUCTION OF CHEMICALS CONSUMPTION IN URANIUM ORE LEACHING PROCESS. Kotula, Edward; Schroeder, Jerzy (Politechnika Wroclawska, Wroclaw). Nukleonika, 11: 345-8(1966). (In Polish).

The digestion of some sifting fractions of granite uranium ore with sulfuric acid was investigated. The data obtained allowed new and more economical leaching circuit with lower chemical consumption to be proposed where uranium ore is divided into two fractions. (auth)

**43442** SEPARATION AND ESTIMATION OF $^{228}$Ra IN THORIUM PLANT EFFLUENT. Kharbanda, J. L.; Rajan, M. V.; Amalraj, R. V.; Thomas, K. T. (Atomic Energy Establishment, Trombay, India). pp 46-51 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Radium-228 separation from monazite processing wastes was studied by precipitation on an anion exchange column in hydroxide form, then counting beta-activity of the daughter $^{228}$Ac. Ferric hydroxide was found to be the best carrier for actinium after studying carrier properties for ammonium, ferric, lanthanum, and yttrium hydroxides. The precipitate was allowed to decay 48 hr to attain an equilibrium ratio of $^{228}$Ra/$^{228}$Ac. Impurities that built up during this decay time also precipitated with $Fe(OH)_3$. Lead, bismuth, polonium, and ferric iron were completely absorbed by a column of strong anion exchange resin in the chloride form. Ferric hydroxide was dissolved in HCl and passed through the resin column in chloride form to obtain pure actinium for counting. (P.C.S.)

**43443** POSSIBLE SEPARATION OF URANIUM FROM THORIUM IN MIXTURES OF $UO_2$–$ThO_2$ BY CHLORINATION. Venkateswarlu, K. S.; Ramaprasad, K. R.; Srinivasan, S. C. (Atomic Energy Establishment, Trombay, India). pp 52-5 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A method was devised for a single-stage chlorination and sublimation of $UCl_4$ for separation of uranium from $ThO_2-UO_2$ mixtures in reprocessing nuclear fuels. A number of chlorinating agents such as $Cl_2$, hexachloropropene, and carbon tetrachloride were studied. Chlorine contaminated the products and hexachloropropene chlorinated only the $UO_3$, so carbon tetrachloride was chosen. Chlorination was effective with $UO_2$ in the range from 500 to 600°C in a nitrogen atmosphere to offset the deterioration of anhydrous $UCl_4$ in contact with water vapor and oxygen. The carry-over of $ThCl_4$ as contamination was 10% in the product. Particle size influenced the reaction. (P.C.S.)

**43444** SOLVENT EXTRACTION OF THORIUM FROM HYDROCHLORIC ACID SOLUTIONS BY DI-n-PENTYL SULPHOXIDE AND DI-n-PENTYL SULPHOXIDE–TRI-n-BUTYL PHOSPHATE MIXTURES IN CARBON TETRACHLORIDE. Gaur, P. K.; Mohanty, S. R.; Reddy, A. S. (Banaras Hindu Univ., India). pp 56-64 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Extraction of thorium from HCl solutions by di-n-pentyl sulfoxide (DPSO) and by mixtures of DPSO and tri-n-butyl phosphate (TBP) in carbon tetrachloride was studied. Experiments were also carried out on extraction of thorium from mixtures of ammonium chloride with HCl by 0.25$\underline{M}$ DPSO as well as by mixtures of DPSO and TBP of various compositions. Extractions occurred at 5 to 11$\underline{M}$ HCl with a maximum at 8$\underline{M}$. Extraction increased progressively with DPSO molarity in the usual sigmoid manner. Extraction also increased with $H^+$ and $Cl^-$ activity. A given mixture entracted more thorium than the sum of the extractions due to individual components. This synergic effect was more pronounced at lower than at higher concentrations of DPSO and TBP. Accuracy of the extraction coefficient was about 1%. (P.C.S.)

**43445** EXTRACTION OF DIVALENT AND TRIVALENT SELECTED METALLIC CATIONS BY DI-ACIDIC PHOSPHORUS-BASED EXTRACTANTS IN A METONE DILUENT. Rao, G. S. (Atomic Energy Establishment, Trombay, India). pp 92-7 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Experiments were carried out to determine the diluent effect of methyl isobutyl ketone on the depolymerizing action and the cation distribution ratios for 2-ethylhexyl phosphate acid ($H_2MEHP$) and 2-ethylhexyl phosphonic acid ($H_2(EHP)$). With $H_2MEHP$ as the extractant, the distribution ratio(K) for each of the three M(III) representatives Tm, Eu, and Am, was found to be inversely third-power dependent on the pH of the aqueous phase. The K values for Ca(II) and $UO_2^{2+}$ were inversely second-power dependent on the aqueous phase pH. Since the K values were independent of the concentration of the nuclide under study, it was concluded that cations extract as mononuclear entities containing no chloride. K values were 2.5-power dependent on the concentration expressed in formality units of $H_2MEHP$ in the extraction phase for M(III) and second-power dependent for Ca(II) and $UO_2^{2+}$. In the corresponding $H_2(EHP)$ study, the K value was inversely third-power pH dependent for the corresponding trivalent metal ions and inversely second-power dependent for the divalent ions. The extractant dependency of K for M(III) was third power and for M(II), second power. The stoichiometries of extractions by various solvents are given. (P.C.S.)

**43446** CHROMATOGRAPHIC SEPARATION OF NIOBIUM AND TANTALUM USING AMINES. Athavale, V. T.; Sonni, K. S.; Venkateswarlu, Ch. (Atomic Energy Establishment, Trombay, India). pp 103-8 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Diethylamine, $\underline{N}$-methyldiphenylamine, and tribenzylamine were studied as reagents for a paper-strip chromatographic separation of niobium and tantalum. Results indicated a fair separation with diethylamine and $\underline{N}$-methyldiphenylamine but not with tribenzylamine. (P.C.S)

**43447** SELECTIVITY COEFFICIENTS OF MONOVALENT CATIONS FOR DINONYLNAPTHALENE SULPHONATE. Khopkar, P. K. (Atomic Energy Establishment, Trombay, India). pp 212-17 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Selectivity coefficients of lithium, sodium, potassium, rubidium, cesium, hydronium, and ammonium ions for dinonylnaphthalenesulfonic acid (DNNS) were determined in n-hexane and chloroform. Though the affinity of the cations decreased with increasing radius of the hydrated cations, $H_3O^+$ and $NH_4^+$ had abnormally high selectivity coefficients for DNNS as compared to those for sulfonic acid cation exchange resins, suggesting a special linkage between these ions and DNNS which is denied to alkali metal ions. A probable linking was suggested through a hydrogen bond, which would be disrupted by water molecules in aqueous media. The value of the selectivity coefficients of alkali metal ions with respect to that of hydronium ions (taken as 1), decreased as the dielectric constant increased. (P.C.S.)

**43448** STUDY ON THE USE OF BISMUTH IODATE IN THE SEPARATION OF TETRAVALENT ACTINIDES. Purkayastha, B. C.; Sen, Shyamoli (Saha Inst. of Nuclear Physics, Calcutta). pp 344-8 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Investigations were performed to study the mechanism of the uptake of $^{234}Th$ by bismuth iodate, and to utilize the possibility of preparation of carrier-free actinides such as $^{234}Th$ free from ter- and hexavalent states. Studies of the constancy of the homogeneous distribution factor of bismuth iodate as host and $^{234}Th$ as guest showed that $^{234}Th$ or tetravalent lanthanides or actinides were taken up through mixed crystal formation (verified by a study of ceric iodate with $^{210}Bi$), but bismuth iodate did not take up $^{152}Eu$, $^{154}Eu$, $^{90}Sr$, and $^{90}Y$. A comparative study of the partition values in the case of $^{234}Th$ as guest and iodates of zirconium, cerium(IV), and bismuth as hosts showed that bismuth iodate was a better carrier than the other two insoluble iodates. A procedure was developed for 90 ± 3% recovery for the separation of $^{234}Th$. (P.C.S.)

**43449** CONTRIBUTIONS TO THE APPLICATION OF CERTAIN ALUMINOSILICATES AS ION EXCHANGERS IN THE DECONTAMINATION OF RADIOACTIVE SOLUTIONS. Lambrino, V. Rev. Chim. (Bucharest), 17: 371-2(June 1966). (In Rumanian).

The decontaminating capacity of Al silicates depends on the Si/Al ratio, chemical composition, ion-exchange capacity, etc. This problem was examined on specimens collected in three different locations in Rumania, using a 0.1-$\mu$C $^{90}SrCl_2$ solution as the contaminating agent. Two of the specimens were found to correspond to montmorillonite. Before use, the specimens were washed, dried, sieved, and calcined at 200, 400, and 600°C in order to remove their water of constitution. The decontamination experiments were based on G-M counter measurements, using a dynamic method involving filtration through a 300-mm long and 15-mm diameter column, and a static one, based on the time of contact. A rapid increase of the decontamination in the case of the two montmorillonite specimens during the first ten seconds was followed by a slower rate, until 88 to 95% decontamination level was reached. The third specimen was eliminated from further testing. The results indicated that the decontaminating capacity is inversely proportional with the CaO, MgO, $K_2O$, and $Na_2O$ content of the specimens. The ion exchange was found to be directly proportional with the amount of aluminum silicate used and with the time of contact. The efficiency was found to increase with increasing heat treatment temperature. The materials are useful for therapeutic applications involving labeled medicinal preparations. (TTT)

**43450** EXTRACTION OF THORIUM BY TRIBUTYL PHOSPHATE FROM NITRIC SOLUTIONS. Tataru, S.; Filip, Gh. (Laboratoire de l'Expedition Geologique, Bucharest). Rev. Roum. Chim., 11: 733-8(June 1966). (In French).

The extraction of thorium, in the form of the nitrate, by tributyl phosphate was studied. The results made possible the determination of the extraction capacity of the solvent under different conditions and determination of the role and the influence of various factors on the extraction. The influence of the concentration of the thorium and of the acid in the initial solution and the role of the diluent in the organic phase were determined exactly by determining the distribution coefficient of thorium between the two phases. The possibility of the extraction of thorium by neutral organophosphorus solvents from very dilute solutions, such as those that result in some cases from the treatment of mineral raw materials, was demonstrated. (tr-auth)

**43451** STUDY OF THE BEHAVIOR OF $^{152}Eu$, $^{147}Pm$, $^{241}Am$, AND $^{246}Cm$ IN SODIUM HEXAMETAPHOSPHATE MEDIUM IN PAPER ELECTROPHORESIS AND SEPARATION OF $^{95}Zr$ AND $^{134}Cs$. Marcu, Gheorghe. Stud. Univ. Babes-Bolyai, Ser. Chem., 11: No. 1, 141-5(1966). (In Rumanian).

The behavior of $^{152}Eu$, $^{147}Pm$, $^{241}Am$, and $^{246}Cm$ in the form of trivalent ions during paper electrophoresis and in Na hexametaphosphate solution was studied. Results showed the formation of stable compounds with negative charges, probably complexes of the form $[Me(III)(Po_3)]^{3-}$, where Me(III) = Eu, Pm, Am, and Cm. These complexes have remarkable stability between the very wide pH limits of 0.65 to 11.0. The electrophoretic mobility of these compounds in the pH range cited was also determined for the potential difference ~900 v. On this basis a fast method was formulated for the separation of $^{152}Eu$, $^{147}Pm$, $^{241}Am$, and $^{246}Cm$ from $^{95}Zr$ and $^{134}Cs$. (tr-auth)

**43452** SEPARATION OF RARE-EARTH ELEMENTS AS THIOCYANATES BY PAPER CHROMATOGRAPHY. Vdovenko, M. E. (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Ukr. Khim. Zh., 32: 284-9(1966). (In Russian).

In order to check the hypothesis that the mechanism of separation of rare earths by paper chromatography is not identical when different solvent mixtures are used, the separation of rare earths in the form of thiocyanates was studied in different mixtures of methyl acetate, ether, and butyl acetate with methanol or acetone. The partition coefficients $K_{part}$ of the rare earths were determined (using yttrium as an example) at various compositions of these mixtures. $R_f$ values were then calculated and compared with values obtained experimentally in a chromatographic separation with the same mixtures. In order to determine $K_{part}$, it was necessary to know the volume of the organic phase; since for a mixture of solvents of which one is completely soluble in water the volume of the organic phase changes as a function of the composition of the mixture, the volume change of the organic phase was determined in the following system of various compositions: saturated solution of ammonium nitrate–mixture of solvents. It was shown shown that in acetone–ester or acetone–ether mixtures the separation followed a simple partition mechanism. In the case of methanol–ester or methanol–ether mixtures, the relation between $R_f$ and $K_{part}$ is more complex. It was concluded that in the chromatographic separation of rare earths in the form of thiocyanates, the maximum differential effect of the solvent mixture corresponds to a definite volume of the organic phase. (ATD)

**43453** THE SEPARATION OF THE LANTHANIDE ELEMENTS AND THE ACTINIDES Am AND Cm WITH AN AMALGAM CATHODE. Thiele, R. Munich, Technical Univ., 1966. 102p. $2.00 Gmelin, AED-Diss. 66-7. Thesis.

The characteristics of amalgams are reviewed. A separation method of $^{242}Cm$ from Am using an ion exchanger is described. For electrolytic separations a well-defined and constant cathode potential is essential. Optimal separation conditions are discussed. Separation factors up to $10^8$ are possible. (Gmelin Inst.)

**43454** STUDIES OF THE TRANSITION OF FISSION PRODUCTS AND ACTINIDES FROM IRRADIATED OXIDES OF U AND Th IN CHLORIDE AND FLUORIDE SYSTEMS. Thomas, R. Brunswick, Technical Univ., 1965. 72p. $2.00 Gmelin, AED-Diss. 65-373. Thesis.

$^{95}Zr$, $^{95}Nb$, $^{103}Ru$, and $^{106}Ru$ can be eluted from uranium oxides with molten NaCl but not $^{141}Ce$ and $^{144}Ce$. Cerium isotopes may be extracted from thorium oxides. The elution process is controlled by diffusion of fission products in solids. Diffusion coefficients and activation energies are given. (Gmelin Inst.)

**43455** KINETICS OF CESIUM SORPTION BY CLAY MINERALS. Sawhney, B. L. (Connecticut Agricultural Experiment Station, New Haven). 21p. (CONF-651114-3; NYO-2955-7). ORAU. Gmelin, AED-CONF-65-342-3.

From American Society of Agronomy, Annual Meeting, Columbus, Ohio.

The processes and time consumed in the sorption of cesium from dilute solutions by illite, montmorillonite, and vermiculite saturated with Ca or K and in the absence of excess saturating cation were investigated. Cesium sorbed by illite and montmorillonite quickly reached an approximate equilibrium; the Cs sorbed by montmorillonite did not change with time while the Cs sorbed by illite changed only slightly. On the other hand, the Cs sorbed by vermiculite did not reach an equilibrium even after 500 hours. Cesium sorbed by calcium vermiculite continued to increase while the Cs sorbed by potassium vermiculite decreased. Since the sorption of Cs by illite is limited to the external planar surfaces and interlattice edges only, equilibrium is quickly reached. Equilibrium in montmorillonite is attributed to its expanded lattice, which makes all exchange sites equally available and permits exchange readily. The increased Cs sorption by calcium vermiculite, on the other hand, is attributed to the different sorption rates by different exchange sites: initial fast sorption on external surfaces and edges followed by slow diffusion into the interlayers. The decreased Cs sorption by potassium vermiculite is perhaps associated with the collapse of the partially hydrated vermiculite in suspension to 10Å. (auth)

# ENGINEERING

## General

*Refer also to abstract 44562.*

**43456** (ORNL-tr-1348) EFFECT OF ALTERNATE TEMPERATURE VARIATIONS ON PRESTRESSING STEELS. CANCELLATION OF RELAXATION. Dumas. Translated for Oak Ridge National Lab., Tenn., from Ann. Inst. Tech. Batiment Trav. Publics, 18: 1254-79(Oct. 1965). 41p. JCL $4.60 fs, $1.43 mf.

Safety of prestressed structures require maximum tension of the steels used. The effects of temperature variations during stress testing are described. Tests show that heat treatment permits the suppression of relaxation and creep without cold-working. The extensiveness of tension losses caused by the relaxation of steels is of primary importance because steels are subjected to a relaxation over a variable length of time (decreasing) and thus to a superposition of relaxation and creep due to delayed deformation of elements in their service life. Full utilization of steels would be increased and the safety of construction greater if prestressed steels were used. The use of this technique would reduce the quantity of steel needed and facilitate the placement of the concrete, increasing the competitiveness of prestressed concrete to other forms of construction. (F.S.)

**43457** CONDENSER BATTERIES WITH 625 kJ STORED ENERGY FOR PRODUCING STRONG MAGNETIC FIELDS. Fertik, S. M.; Taller, E. G.; Konotop, V. V.; Linetskii, V. Ya.; Gladkov, V. S.; Goliushko, G. M. pp 137-46 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

A design is given of a condenser battery of 625-kJ stored energy for producing strong pulsed magnetic fields the storage element set at a total energy can be switched for 50, 100, 200, and 250 kw. The first stage of the battery, with 157.5-kJ stored energy, is now in operation. (R.V.J.)

**43458** STUDIES OF THE PERFORMANCE OF 625-kj BATTERY USING A PHYSICAL MODEL. Konotop, V. V.; Gladkov, V. S.; Nemchenko, Yu. S. pp 147-56 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The performance of a 625-kJ battery was tested using a model. The battery consisted of 52 special low-induction capacitors, commuting elements (dischargers), coaxial cable busbars, with up to twelve cables from each capacitor and up to 700 from the whole battery. A low-voltage battery was tested under normal and emergency conditions. (R.V.J.)

**43459** AMERICAN STANDARD DESIGN GUIDE FOR A RADIOISOTOPE LABORATORY (TYPE B). New York, American Standards Association, 1963. 18p. $1.00.

Specifications are presented for a radioisotope laboratory. Recommendations are based on radiotoxicity of the isotopes to be used. Building services such as ventilation, lighting, waste disposal, vacuum system, safety showers, and fire prevention and the laboratory work area features such as surface finishes, hood, and facilities are described in detail. (H.G.D.)

## Applications of Nuclear Explosions

**43460** (ORNL-P-2389) FEASIBILITY OF CERTAIN EXPERIMENTS USING UNDERGROUND NUCLEAR EXPLOSIONS. Dabbs, J. W. T. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 5p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Two types of experiments using underground nuclear-explosions are discussed; experiments with nuclei oriented at very low temperatures, and direct measurements of fission lifetimes. In the first type, it was concluded that such experiments, especially fission experiments, probably should not be performed using an underground nuclear explosion as a neutron source, because of unavoidable heating associated with the rapidity of the experiment. It was found that only a small number of unusual cases are at all feasible. In the second type, a new experiment was proposed in which the passage of a recoiling compound nucleus through a crystal lattice may provide direct time-of-flight determinations of the lifetime against fission. The experiment utilizes the recently discovered "blocking" or anti-channeling" effect in crystals. The feasibility of the experiment was discussed, with the conclusion that such neutron fission experiments are possible only with underground nuclear explosions as neutron sources. (auth)

**43461** (PNE-607F) MULTIPLE ROW CHARGE BLAST-WAVE OBSERVATIONS AT LONG RANGE. Final Report. Project DUGOUT. Reed, Jack W. (Sandia Corp., Albuquerque, N. Mex.). Mar. 1966. Contract AT(29-1)-789. 28p. Dep. mn. CFSTI $1.50 cy, $0.50 mn.

Air-blast wave measurements were made at ranges from 4 km to 200 km from the Plowshare Dugout high-explosives cratering event at the Nevada Test Site. In the Dugout event, a row of five nitromethane spheres were arranged to create a maximum ditch. Thirteen microbarograph stations were operated to determine how much attenuation of the blast wave was caused by explosives burial. Results showed that distant wave amplitudes ranged from 0.11 to 0.49 times as large as would have propagated from one of the nitromethane spheres burst in free air. Rocket wind observations were made to allow sound-ray propagation calculations for comparison with observations. In general, propagations were stronger than this calculation predicted. Three smaller explosives were burst above ground and one was burst on the ground to check atmospheric propagation conditions and to calibrate Dugout waves. Records from identical aboveground bursts, fired in a 5-minute period, showed that blast amplitudes were repeatable only within a factor of 0.70 to 1.43. (auth)

**43462** (UCRL-13225) NEAR-SURFACE SPALLING FROM A NUCLEAR EXPLOSION IN A SALT DOME. Eisler, J. D. (Stanford Research Inst., Menlo Park, Calif.). [1966]. Contract W-7405-eng-48. 32p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Although near-surface spalling observed on the Salmon nuclear shot resembled that observed on other shots in different environments, the spalling process was more complex because of an artificially filled platform at surface zero. The Salmon maximum spall gap width (0.1 m) in the vicinity of surface zero was roughly $\frac{1}{6}$ of that which would be expected without the platform. The radius was 460 m, and the spalled layer thickness was 11.7 m. Measurements established that the near-surface layers had experienced multiple bouncing rather than successive spallation. (auth)

**43463** (UCRL-14756) INDUSTRIAL APPLICATIONS OF CONTAINED NUCLEAR EXPLOSIONS. Rawson, Donald E. (Lawrence Radiation Lab., Univ. of California, Livermore). July 1966. Contract W-7405-eng-48. 59p. Dep. mn. CFSTI $2.00 cy, $0.75 mn.

The phenomena and technology of contained (nonexcavation) nuclear explosions as they relate to potential industrial uses are summarized. The results of nuclear explosions of a given yield, at a given depth, and in a known geologic setting are understood sufficiently that further explosions can be conducted safely and, within limits, the characteristics of the resulting environment can be predicted. The features of contained nuclear explosions that should be of most interest to industry are (1) the creation of a large void underground in the form of a cavity generated by the explosion. This void becomes distributed between rubble fragments when the roof of the unstable cavity collapses; (2) the creation of a large amount of fragmented rock distributed within a chimney that develops as a result of the collapse of the roof of the cavity; (3) the fracturing of rock surrounding the cavity-chimney region and associated increased permeability in most rock types. To illustrate the magnitudes of these effects, a 100-kiloton explosion at a depth of 900 meters (3000 feet) will produce a cavity with a radius of about 45 meters (148 feet) or a void volume of 1.23 million cubic meters (43.5 million cubic feet). Cavity roof collapse will extend about 194 meters (635 feet) above the explosion center and will contain 1.61 million tons of rubble. About ten times this tonnage may be cracked and become more permeable. The environment resulting from a contained nuclear explosion has applications leading to the recovery of oil, natural gas, minerals, water, and geothermal energy; to the underground storage of oil, natural gas, water, and compressed air; and to the disposal of fluid waste. (auth)

**43464** MINERALOGICAL INVESTIGATIONS IN THE DEBRIS OF THE GNOME EVENT NEAR CARLSBAD, NEW MEXICO. Kahn, J. S.; Smith, D. K. (Univ. of California, Livermore). Contract W-7405-eng-48. Amer. Mineral., 51: 1192-9(July 1966). (UCRL-7879).

Mineralogical studies on debris formed during the underground Gnome nuclear explosion in a salt horizon of the Salado formation near Carlsbad, New Mexico have shown that significant quantities of olivine and kirschsteinite are present in the water insoluble fraction. Particles containing these minerals are generally strongly radioactive and suggest the minerals have had a role in localizing fission products. The size (10–500 $\mu$) and spherical shape of the silicate particles suggest that they were immiscible droplets in the salt melt which preferentially dissolved the fission products before crystallizing. The subsequent crystallization excluded the actinides from within the crystallites, leaving them on the crystallite boundaries. (auth)

## Facilities and Equipment

**43465** (AECL-2592) AN IMPROVED SHEATHED ELECTRIC HEATER. Quarrington, J. A.; Wikhammer, G. A. (Atomic Energy of Canada Ltd., Chalk River (Ontario)). July 1966. 14p. (PE-16). Dep. mn. AECL $0.50.

Heaters were designed and built to give a surface heat flux in excess of 300 watts per square centimeter (ca. 1,000,000 BTU/sq.ft/hr). Heaters were designed to produce a high, uniform thermal conductance. Precision assembly techniques ensure concentricity between the heater spiral and the metal sheath with minimum insulation thickness. High density boron nitride is used for electrical insulation; the high thermal conductivity of this material results in a relatively low heater spiral temperature. Methods of construction are also described. (auth)

**43466** (DP-MS-66-16) CONTAINMENT METHODS FOR ALPHA-GAMMA RADIOACTIVITY AT SAVANNAH RIVER LABORATORY CAVES. Kelsch, R. D. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). July 1966. Contract AT(07-2)-1. 30p. (CONF-661001-14). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

For Presentation at 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

In the Savannah River Laboratory's High Level Caves, beta-gamma cells are used routinely for work involving high alpha-gamma activity. Alpha containment is achieved by: maintaining the inlet air velocity through all openings in the cell shield >100 feet per minute at all times; using laminar flow patterns in the cell to flush out airborne activity; filtering exhausted air through two absolute and one charcoal filter; controlling air flow patterns in the area adjacent to the cells with air locks; and using double bagging methods to transfer contaminated equipment from the cell. This method of alpha containment permits efficient operation of the in-line cells, and reduces maintenance by eliminating in-cell containment boxes, transfer locks, and seals. (auth)

**43467** (TID-23343) STRESSES AT NOZZLES IN SPHERICAL SHELLS LOADED WITH PRESSURE, MOMENT OR THRUST. Phase Report No. 2. Rodabaugh, E. C. (Battelle Memorial Inst., Columbus, Ohio); Witt, F. J. (Oak Ridge National Lab., Tenn.); Cloud, R. L. (Bettis Atomic Power Lab., Pittsburgh, Pa.). July 15, 1966. Contract W-7405-eng-92. 224p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

To evaluate internal and external pressures at nozzles in pressure vessels, 4 "two-piece" shell theories were compared: Bijlaard–moment or thrust loadings; Waters–internal pressure; Leckie-Penny–internal pressure, moment or thrust loadings; and Kalnins–internal pressure, moment or thrust loadings. The basis of each of these theories is discussed. Within the range of dimensional parameters covered, it was found that Bijlaard, Leckie-Penny and Kalnins theories give essentially the same results. Waters theory gives different results than Leckie-Penny or Kalnins theories; the reasons for these differences are considered and numerical comparisons are given. "Multi-piece" shell theories used (in the form of computer programs) were those of Kalnins and Seal-Shell-2. The development of these two programs is discussed, along with numerical comparisons: Kalnins theory is based on thin-shell assumptions; Seal-Shell-2 is more applicable to thick shells and, in general, agrees better with test data than Kalnins. A computer program entitled "BASIC," which uses point matching for axisymmetric bodies of revolution subjected to axisymmetric forces, is discussed and the results for an example are shown. (auth)

**43468** (TID-23344) FLEXIBILITY OF NOZZLES IN SPHERICAL SHELLS. Phase Report No. 3. Rodabaugh, E. C.; Atterbury, T. J. (Battelle Memorial Inst., Columbus, Ohio). June 28, 1966. Contract W-7405-eng-92. 32p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Design graphs are presented by means of which the flexibility can be determined for nozzles in spherical heads, or in heads which are locally spherical in the vicinity of the nozzle. Graphs are applicable for $10 \leq D/T \leq 250$, $d/D \leq 0.5$, and $t/T \leq 3.0$. Both the nozzle and sphere are assumed to have constant wall thickness in the vicinity of the nozzle and the nozzle protrudes externally only. Graphs for flexibility are given for both moment and thrust loadings applied to the nozzles. The significance of the flexibility of nozzles in heads, as a part of a piping system, is illustrated by calculation of forces and moments in a number of simple piping systems with the usual assumption of the nozzle as an anchor and with the nozzle flexibility included. For this particular set of examples, the ratio $(M_n)_0/(M_n)_K$ ranges from 2.5 to 6, i.e., the moment at the nozzle is overestimated by factors of 2.5 to 6 by using the "anchor" assumption. These examples were selected to show where the nozzle flexibility factor can be significant; in many piping systems the effect of the nozzle flexibility will be insignificant. (auth)

**43469** (TID-23350) AN EXPERIMENTAL STUDY OF FLOW PHENOMENA IN THE FEEDING REGION OF AN EXTERNALLY PRESSURIZED GAS BEARING. Vohr, J. H. (Mechanical Technology Inc., Latham, N. Y.). July 21, 1966. Contract Nonr-3730(00). 53p. (MTI-65TR47). Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Recent measurements made of film entrance losses for circular, externally pressurized, gas bearings under subsonic flow conditions are described. The nature of the flow in the entrance region was studied by means of pressure profile measurements. Measurements were made of the recovery downstream of an orifice discharging into the bearing feeding hole and of the influence of this orifice on film entrance pressure loss. The significance of these various phenomena on bearing performance was demonstrated by a calculation for a typical bearing. (R.C.K.)

**43470** (UCRL-14743) REMOTIZED BOLT CUTTER. Hayes, Wesley N. Jr. (Lawrence Radiation Lab., Univ. of California, Livermore). Mar. 3, 1966. Contract W-7405-eng-48. 3p. (CONF-661104-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 14th Conference on Remote Systems and Technology, Washington, D. C.

A remotized hydraulic bolt cutter is described which facilitates disposal of radioactive waste from reactor capsules generated in hot cells. (B.G.D.)

**43471** APPLICATION OF PLASTICS IN NUCLEAR ENGINEERING. **Dominінghaus, Hans** (Farbwerke Hoechst AG, Frankfurt am Main). **Brit. Plast., 38: 676-81(Nov. 1965).**

Plastics are used in protecting technicians working near sources of radiation; protecting surroundings against damage from contaminated water or air; insulating electrical plants and equipment; constructing high vacuum systems and equipment for detecting, counting, and registering high density radiation; protecting construction materials against weather, and for the production of long-lasting building elements. (F.S.)

**43472** CLOSED-CIRCUIT TELEVISION IN THE NUCLEAR INDUSTRY. **Stephens, K. G.** (Battersea Coll. of Tech., London); **Kesteloot, A. V. Ind. Electron., 4: 204-11(May 1966).**

Three types of television camera used in the nuclear industry are described: those operating within reactors, those for hot-cell and radioactive-chemical processing work, and the standard cameras used to bring all potential danger areas within the immediate observation of a reactor operator. Some of the cameras used in reactors and hot cells, and the problems that have to be overcome to produce useful instruments for these difficult environments, are considered. Consideration is given to the damage produced by $\gamma$ radiation on components used in television cameras. Development of a hot-cell radiation-resistant camera is discussed. A small camera for hot-cell use has now been produced using a $\frac{1}{2}$ in. dia. vidicon. It has a length of 23 in. and a dia of $1\frac{1}{4}$ in. It is made entirely of stainless steel, is equipped with a stabilized glass window and lenses, and can be fitted with various attachments. By adding a suitable seal, these cameras can also be used underwater in radioactive environments. The design of a camera for use in-core is shown and described in detail. (BBB)

**43473** APPARATUS FOR NEUTRON DIFFRACTOMETRY OF SPECIMENS UNDER HIGH HYDROSTATIC PRESSURE. **Litvin, D. F.; Ponyatovskii, E. G.** (Bardin Central Ferrous Metallurgy Research Inst., USSR). **Soviet Phys.-Cryst. (Engl. Transl.), 11: 322-3(Sept.-Oct. 1966).**

Translated from Kristallografiya, 11: 354-6(Mar.-Apr. 1966).

An apparatus for examining materials under high hydrostatic pressure by neutron diffraction includes a double hydraulic press that develops forces up to 100 tons and encloses the pressure chamber. Two pressure-chamber designs were tested, the first for use with true hydrostatic pressure and the second with quasihydrostatic pressure. Both consist of a Ti-Zr pressure vessel strengthened by massive steel supports. The first was found convenient for studies on single crystals; the second was more convenient for powder-pattern studies. (A.G.W.)

**43474** IMPROVEMENTS IN OR RELATING TO MECHANICAL HANDLING EQUIPMENT. **Lightford, George Robert; Clare, Ernest** (to United Kingdom Atomic Energy Authority). **British Patent 1,032,212. June 8, 1966. Filed Apr. 24, 1962.**

An apparatus is described for measuring the overall length of a column of repetitively produced bodies such as cylindrical pellets of nuclear fuel. The apparatus includes a channel for supporting an end-to-end column of the repetitively produced bodies. The channel has a feed end and a stop end with mechanism at the stop end for repeatedly removing a body from the leading end of the column and with mechanism at the feed end for repeatedly feeding a body onto the channel to restore the total number of bodies on the channel and move the bodies toward the stop end of the channel. At intervals corresponding to the feeding onto the channel of a predetermined number of bodies, the removing and feeding mechanisms are arrested; and the length of the column of bodies is automatically gaged. (B.L.M.)

**43475** IMPROVEMENTS IN OR RELATING TO RADIOACTIVE MATERIAL CONTAINERS. **Pearson, John Edwin James; Ford, John Brian Malpas** (to Tech Del Ltd.). **British Patent 1,037,545. July 27, 1966. Filed June 12, 1963.**

A radioactive material container comprises two shield members, the second movable within the first. An elongated passageway is provided in the second shield member and extends to the surface of the shield member to slidably receive the radioactive material. A second elongated passageway is directed transversely of the first passageway and communicates with the first. By moving the second shield member relative to the first shield member, the entrance to the first passageway can be moved from a position where it is masked by the first shield member to a position where it is exposed and vice versa. The two passageways contain a fluid, and means are associated with the passageways for applying pressure to the fluid in the second passageway to cause corresponding pressurization of the fluid in the first passageway to bring about movement of the radioactive material along the first passageway when the second shielded member is in a position so that the entrance to the first passageway is not masked. (B.L.M.)

**43476** CONTAINER SYSTEM FOR RADIOACTIVE MATERIAL. **Grasty, William P.** (to Abbott Labs.). **U. S. Patent 3,256,441. June 14, 1966. Filed Nov. 26, 1962.**

A container system for radioactive materials comprises an inner and outer container with a space between the containers and with an absorbing material beneath the inner container to absorb any radioactive material that might leak from damage to the inner container. A number of spaced upstanding fingers are provided in the outer container which is made of shielding material. The inner container has a floor and a shoulder upward from the floor. This shoulder seats on the end of each upstanding finger. This arrangement serves to hold the inner container against accidental movement relative to the outer container. The inner container is locked within the outer container and the container is hermetically sealed against leakage. The container and closure may be made of shielding material containing a sufficient amount of thermoplastic resin material to render the shielding material readily sealable; in which case a substantially planer overseal is sealed to the upper terminal end of the container and the closure. (B.L.M.)

# Heat Transfer and Fluid Flow

***See also* PHYSICS — Fluid Physics and Thermodynamics**

*Refer also to abstract 43913.*

**43477** (CONF-661102-1) CONDENSATION HEAT TRANSFER AT AN AGITATED, STEAM-WATER INTERFACE. Jones, Owen C. Jr. (Knolls Atomic Power Lab., Schenectady, N. Y.). June 1966. Contract W-31-109-eng-52. 31p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

For Presentation at American Society of Mechanical Engineers, Winter Annual Conference, New York.

Condensation heat-transfer experiments were conducted for a low-pressure, subsurface jet-agitated, steam-water interface. Nusselt numbers were found to correlate well with the ratio of Grashof number to Reynolds number squared, $(Gr/Re^2)$, based on jet exit depth and overall difference between the steam temperature and the temperature of the entering agitating jet. A critical depth was postulated and shown experimentally to be the limiting jet exit depth beyond which there was no interfacial agitation. A macroscopic analysis, assuming buoyancy to be the governing mechanism, yielded a good graphical correlation. The exponent in the correlation, however, did not accurately describe the trends. Instead, experiments showed, and further analysis verified, that the viscous effects were predominant, giving a linear relationship between the critical depth and the jet exit Reynolds number. Color films of the flow pattern and surface condensation layer were taken with the aid of dye injection. Measurements showed a linear relationship between jet radius and distance above the jet, in agreement with Prandtl mixing-length theory. The constant of proportionality was found to differ markedly from that given by other investigators for a horizontal jet in a semi-infinite medium. The range of parameters covered by the experiment included $5.6 \times 10^3 \leq \mathrm{Re} \leq 1.4 \times 10^5$, $6.0 \times 10^7\ \mathrm{Gr} \leq 3.1 \times 10^{10}$, $4.5 \leq \mathrm{Nu} \leq 7.2 \times 10^2$, and $8.8 \times 10^{-2} \leq \mathrm{Gr}/\mathrm{Re}^2 \leq 9.1$. (auth)

**43478** (EURAEC–1620) RESEARCH INTO THE CRITICAL HEAT FLUX (BURNOUT) IN BOILING WATER. Final Report on Pulsating Burnout. Mayinger, F.; Schad, O.; Weiss, E. (Maschinenfabrik Augsburg-Nuernberg A. G., Nuremberg (West Germany)). Mar. 1966. Contract 057-61-RDD. 151p. In English and German. (EUR-2833). Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Work Performed under United States–Euratom Joint Research and Development Program.

The physical phenomena in pulsating burnout and its dependency on various thermodynamic, hydrodynamic and geometric parameters as well as the layout of the test loop was investigated in numerous tests covering over 1200 test points. The tests were made on internally cooled round individual tubes of 7 to 15 mm diameter and a length/diameter ratio of the heated section of 5 to 140 and include mass flows from 100 to 400 $\mathrm{g/cm^2}$ sec in a pressure range from 70 to 140 $\mathrm{kgf/cm^2}$. Pulsating burnout can arise only in flows with sub-cooled boiling and with a very low steam quality. By providing for sufficient throttling of the flow at the inlet to the heated channel as well as by eliminating any compressible volumes in the loop between the circulating pump and the heated channel, efficient control of the pulsating burnout can be obtained. (auth)

**43479** (JAERI–1108) JP-HYDRO: A CODE FOR THE STUDY OF THE THERMAL-HYDRO DYNAMICS IN A NATURAL-CIRCULATION, BOILING-WATER NUCLEAR REACTOR. Moriguchi, Kin-ichi; Kosaka, Atsuo; Kuge, Yasushi; Kobori, Tetsuo (Japan Atomic Energy Research Inst., Tokyo). Aug. 1965. 16p. (In Japanese). Dep. mn.

The numerical code "JP-Hydro" was developed for calculation of the distributions of voids and flow velocities in the natural circulation system of a BWR type nuclear reactor, which is in steady state operation. The code can be used for such flow systems as involves a combination of multichannel and single channel parts; the former includes the core assemblies and risers, and the latter a series of a chimney, a downcomer and lower plenum. In formulating the various types of pressure losses the method described in ANL 6063 was used, while the model proposed by G. W. Maurer was employed in considering the process of void formation. A new method of the rapid and stable numerical computation for the type of complex system was developed, utilizing the specific property of the established function. The code is also applicable to the case of a forced circulation system. (auth)

**43480** (LA–3543) THERMAL-ACOUSTIC OSCILLATIONS INDUCED BY FORCED CONVECTION HEATING OF DENSE HYDROGEN. Thurston, Rodney S. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). Apr. 1966. Contract W-7405-eng-36. 159p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Thesis. Submitted to New Mexico Univ., Albuquerque.

A theoretical investigation of thermal-acoustic oscillations was made with the use of a nonlinear perturbation analysis and a dense-core, superheated-film model. Acoustic frequencies were used as a reference for thermal-acoustic oscillations. An experimental investigation of thermal-acoustic oscillations during forced convection heating of dense hydrogen was made at sub and supercritical pressures between 112 and 265 psia. The experiments were performed on a $\frac{1}{4}$ inch ID by 10 foot long electrically heated stainless steel tube between plena. In some cases the tube was heated over its entire length. In other cases only the inlet one-third and only the outlet two-thirds of the tube length were heated. Inlet Reynolds numbers were varied between 35,000 and 900,000. Boiling numbers ranged from 0.00026 to 0.0013. Strouhal numbers ranged from 0.37 to 23. Thermal-acoustic oscillations in pressure, fluid temperature, and volumetric rate of flow were observed. An empirical equation was obtained between the boiling number and specific volume number at the inception of oscillations. The observed frequencies were related to acoustic frequencies of Helmholtz and open-open pipe resonance. The observed frequencies were between 4 and 38 cps for the Helmholtz mode, and between 50 and 150 cps for the first harmonic of the pipe mode. The ratio of observed to acoustic frequencies were correlated versus Strouhal number. At Strouhal numbers greater than 2.0 the ratio was one. The maximum peak to peak pressure amplitude was 50 psi. The maximum peak to peak temperature amplitude of the hydrogen was 138°R. The amplitudes of pressure oscillations were correlated by an amplitude number as a function of a boiling number minus the inception boiling number. (auth)

**43481** (NYO–3237-6) EXPERIMENTAL TEST AND EVALUATION OF A GAS-BEARING BRAYTON CYCLE TURBOCOMPRESSOR. Quarterly Progress Report, March 1–June 20, 1966. Meacher, J. S. (Mechanical Technology Inc., Latham, N. Y.). Aug. 26, 1966. Contract AT(30-1)-3237. 46p. (MTI–66TR44). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The application of gas-lubricated bearings to closed-system gas-turbine machinery is described, a Brayton cycle gas generator (turbocompressor) utilizing self-acting gas bearings was designed, built, and is under test. Self-sustained closed-loop operation of the turbocompressor, using its own cycle gas as the bearing lubricant, was achieved. The turbocompressor has been successfully operated, with nitrogen, at 1300°F to 1400°F turbine inlet temperature, 24,600 rpm, a maximum equivalent output load of 37.6 KW(e) 15 and 20 psia compressor inlet pressure, under compressor surge conditions, and under transient conditions due to step changes in heater input power and compressor inlet temperature. (auth)

**43482** (ORNL-TM–1519) THEORETICAL SLIP RATIOS IN ANNULAR TWO-PHASE FLOW. Wichner, R. P. (Oak Ridge National Lab., Tenn.). May 9, 1966. Contract W-7405-eng-26. 25p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

An expression for the slip ratio (i.e., the ratio of the mean vapor velocity to that of the liquid) in annular two-phase flow is developed under the assumptions of laminar flow in the liquid film and non-rippling of the interfacial surface. The solution is presented for up, down, and zero-gravity flow in terms of the following three dimensionless quantities: (1) the vapor volume fraction, (2) a parameter, B, depending on the liquid and vapor physical properties, tube radium, and friction factor of the vapor flow, and (3) an interfacial shear stress parameter. The critical condition for zero net liquid upflow is specified as occurring when the interfacial shear stress parameter is equal to a derived function of the volume fraction. Liquid velocity profiles and volumetric flow rates are also derived. Numerical values of the slip ratio for saturated water at 212°F and potassium at 1850°F are found to have the same trends with quality as the prediction of Lockhart-Martinelli, and are remarkably close in magnitude considering the simplicity of the model. (auth)

**43483** (RPI–3639-1) STUDIES OF GAS-PARTICLE HEAT TRANSFER COEFFICIENTS IN PACKED AND FLUIDIZED BEDS BY FREQUENCY RESPONSE TECHNIQUES. Annual Progress Report, January 1, 1966–

December 31, 1966. Littman, Howard (Rensselaer Polytechnic Inst., Troy, N. Y.). Oct. 1966. Contract AT(30-1)-3639. 48p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Includes RPI–3639-2.

Models used for interpreting heat transfer measurements, heat transfer coefficients, solid phase conductivities, and gas phase dispersion coefficients for packed beds are described. Gas–particle heat transfer coefficients in fluidized beds were measured by steady state, unsteady state, and steady state periodic methods. The coefficients obtained from unsteady state measurements were 10 to 500 times lower than those given by Frantz's correlation of coefficients measured by steady state methods. The periodic method gave minimum values of the Nusselt number; at a Reynolds number of 0.88, the minimum value was greater than that obtained by the other two methods, and at Reynolds numbers of 31 and 33, the minimum value fell between those obtained by the other methods. (R.C.K.)

**43484** (STL–372-38) KINETIC STUDIES OF HETEROGENEOUS WATER REACTORS. Quarterly Progress Report for Period Ending March 31, 1966. Firstenberg, A.; Neal, L. G. (TRW Systems, Redondo Beach, Calif.). Apr. 15, 1966. Contract AT(04-3)-372. 49p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

An experiment was performed for simultaneously measuring the power, inlet flow rate, inlet subcooling, exit void fraction, and exit momentum flux in the geometry of a simulated SPERT 1A moderator-coolant channel at atmospheric pressure. The measurement of both mass flux and momentum flux allows one to define and evaluate a single parameter chosen to characterize the distributional effects. In addition to the steady state measurements, the response of the momentum flux to power modulation was measured in the form of power-momentum transfer functions. (M.O.W.)

**43485** BOILING POTASSIUM HEAT TRANSFER IN A TUBE AT MODERATE VAPOR CONTENT VALUE. Borishanskii, V. M.; Andreevskii, A. A.; Zhokhov, K. A.; Bykov, G. S.; Svetlova, L. S. At. Energ. (USSR), 21: 58-9 (July 1966). (In Russian).

Boiling potassium heat transfer in 10-mm dia and 600- to 800-mm long circular tubes constructed from 1Cr18H9T steel was investigated. Potassium temperatures were measured at 30, 90, and 210 mm from the entrance and 30 mm from the outlet at saturation pressures of 0.42 to 3.38 atm ($t_5$ = 678 to 910°C) and heat loads to 530,000 kcal/mh. The vapor content at the outlet reached ~15%. Temperature distribution along the tube is plotted. (R.V.J.)

**43486** SUBCOOLED NUCLEATE BOILING WITH ORGANIC COOLANTS AND EXPERIMENTATIONS WITH ORTHOTERPHENYL. Cumo, M.; Palmieri, A.; Urbani, G.; Valeri, D. Calore, 35: 533-46(1964). (In Italian).

Experimental studies were made in forced convection subcooled nucleate boiling with orthoterphenyl. The results obtained on the heat flux as a function of temperature difference between the heating surface and the liquid at different values of velocity and subcooling are reported. The experimental use of orthoterphenyl instead of terphenyl mixtures is advantageous in that its physical properties (both in liquid and vapor phases) are well known. (tr-auth)

**43487** SOME STUDIES OF HEAT TRANSFER FROM ROUGHENED SURFACES TO A GASEOUS COOLANT. I. HEAT TRANSFER FROM SURFACES ROUGHENED BY RIBS AND GROOVES SIMULTANEOUSLY. Wilkie, D. (United Kingdom Atomic Energy Authority, Seascale, Eng.). J. Nucl. Energy: Pt. A and B, 20: 537-43(July 1966).

Heat transfer tests on ribbed surfaces with grooves added to prevent wrinkling and ratchetting indicate that although the mean performance would be little altered if the relative positions of the ribs and grooves varied along a reactor fuel element, serious hot-spots would be produced. (auth)

**43488** SOME STUDIES OF HEAT TRANSFER FROM ROUGHENED SURFACES TO A GASEOUS COOLANT. II. HEAT-TRANSFER PERFORMANCE OF A ROUGH SURFACE FORMED BY PRESSURIZING A CAN ON TO CONICAL PELLETS. Wilkie, D. (United Kingdom Atomic Energy Authority, Seascale, Eng.). J. Nucl. Energy: Pt. A and B, 20: 545-8(July 1966).

Heat transfer measurements were made on a type of rough surface that could be obtained by pressurizing thin stainless-steel cans onto fuel pellets shaped like truncated cones. The results indicate that with the coolant flow in a particular direction the surface has a performance close to that of a ribbed surface having the same friction factor. (auth)

**43489** ANALYSIS OF THE HEAT TRANSFER IN FUEL ELEMENT BUNDLES. Simonek, Jiri. Jad. Energ., 12: 246-9(1966). (In Czech).

Data on heat transfer in rod bundles are reported and compared with experimental results. The experiments were carried out in air and carbon dioxide at a pressure of $6 \times 10^6$ N/m$^2$ in the temperature interval from 60 to 400°C up to thermal flux densities of 350,000 kcal/m$^2$hr. On the basis of the experimental results, the dependence between dimensionless criteria in the form $Nu = 0.0261\ Re^{0.8}\ Pr^{0.4}\ (T/T_w)^{0.55}$ and for calculations of the coefficients of hydraulic resistance the expression $\xi = 0.0357/Re^{0.43}\ (T/T_w)^{0.55}$ were determined for rod bundles in longitudinally flowing gases. The results obtained were higher than those reported in the literature. (tr-auth)

**43490** TWO-DIMENSIONAL ISOTHERMAL FLOW OF CONDUCTING LIQUID AND GAS IN A CHANNEL WITH ELECTRIC AND MAGNETIC FIELDS. Kukin, I. K.; Smolin, G. G. Teplofiz. Vysok. Temp., 4: 73-9(1966). (In Russian).

Studies were made of a two-dimensional steady laminar isothermic conducting fluid flow in a plane channel with crossed electric and magnetic fields. An approximation equation similar to the boundary layer equations was used and model solutions expressed by means of Jacoby elliptic functions were found. The rate and pressure ratios along the channel axis applicable to the incompressed fluid were developed. (tr-auth)

# Materials Testing

*Refer also to abstract 43866.*

**43491** (ORNL-P-2472) COMPARISON OF THEORETICAL AND EXPERIMENTAL RESULTS FROM SPHERICAL SHELLS WITH A SINGLE RADIALLY ATTACHED NOZZLE. Witt, F. J.; Gwaltney, R. C. (Oak Ridge National Lab., Tenn.); Maxwell, R. L.; Holland, R. W. (Tennessee Univ., Knoxville). [1965]. Contract W-7405-eng-26. 22p. (CONF-661102–5). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

For Presentation at American Society of Mechanical Engineers, Winter Annual Conference, New York.

A series of steel models having single nozzles radially and nonradially attached to a spherical shell was examined by means of strain gages. Parameters studied were nozzle dimensions, length of internal nozzle protrusions, and angles of attachment. The loads are internal pressure, axial thrust, and moment loadings on the nozzle. Both experimental and theoretical results from six of the configurations having radially attached nozzles for which the sphere dimensions are equal and the outside diameter of the attached nozzle is constant are given. In some instances the nozzle protrudes through the vessel. (auth)

**43492** (ORNL–TM–1312(Vol.2)) STRUCTURAL ANALYSIS OF SHIPPING CASKS. VOL. 2. RESISTANCE TO PUNCTURE. Spaller, A. E. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 67p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Empirical equations that will satisfy the Atomic Energy Commission's proposed regulations pertaining to the puncture resistance of the outer jacket of steel-jacketed lead-shielded casks used for shipping radioactive materials are developed. A small-scale model of a prototype cask was tested to determine its puncture resistance, and the results were used to develop a test rig simulating one side of this model. The test rig was then used to develop scale-model puncture-resistance data for two materials: hot-rolled steel, ASTM A245 grade A, and type 304L stainless steel, ASTM A240. The puncture-resistance data from the scale-model tests were extended to apply to full-scale casks, and several tests were conducted with a full-scale prototype cask. The results of these tests substantiated the data extended from the model tests. Two empirical equations are recommended as alternates to the puncture tests recommended by the Atomic Energy Commission. They are: $t = (1.22 \times 10^{-3})W^{0.618}$, for hot-rolled steel, ASTM grade A or ASTM A285 grade B, and $t = (2.07 \times 10^{-5})W - (1.306 \times 10^{-10})W^2$, for type 304L stainless steel, ASTM A240. It is also recommended that these empirical equations be extended to include other materials and curvature of the outer jacket of casks. (auth)

**43493** RADIATION-RESISTANT FLUIDS AND LUBRICANTS. **Hollinghurst, R. (Mobil Oil Co. Ltd., Essex, Eng.). J. Inst. Petrol., 52: 9-29(Jan. 1966).**

The development of lubricants and fluids stable to radiation dosages of $10^9$ rads at temperatures up to 650 to 700°F is outlined. It is concerned both with petroleum-based and synthetic-hydrocarbon-based materials. A high-sulfur content is shown to reduce viscosity increase under irradiation. This effect is sometimes more pronounced than the protection against viscosity increase afforded by a high aromatic content. The most radiation stable, readily available aromatic additives, with a good liquid range, appear to be blends of partially hydrogenated ring compounds with an aromatic ring content of less than 70%. These materials were irradiated alone and in combination with aromatic hydrocarbon polymers and aromatic sulfur compounds. Both air and nitrogen atmospheres were used. The data are compared with published information on other synthetic aromatic fluids and show the partially hydrogenated blends to be excellent. The effects of combined $\gamma$ radiation and thermal damage were also studied up to 650°F in a specially built apparatus. The relative importance of radiation and thermal stability is discussed in terms of viscosity increase and evolved-gas composition. (auth)

**43494** RESOLUTION LIMITS IN RADIOGRAPHY. Seda, Josef **(Inst. of Theoretical and Nuclear Physics, Prague). Jad. Energ., 12: 250-4(1966). (In Czech).**

A theoretical analysis of the possibility of increasing the resolution in radiography is given. On the basis of the relation of useful and interfering signals, the optimum conditions for radiographic measurement were determined. It was shown that in those cases where the attenuation of the radiation proceeds by an exponential rule, the resolution can be theoretically increased for any form of the interfering signals and that high resolution can be obtained in the use of detectors registering low-intensity radiation. (tr-auth)

## Protective Structures

**43495** (AD-628806) EXPERIMENTAL STUDY OF STRESS WAVE INTERACTION IN PHOTOVISCOELASTIC PLATES. [Period Covered], October 1, 1963-February 5, 1965. Daniel, I. M. (IIT Research Inst., Chicago, Ill.). Jan. 1966. Contract AF29(601)-6240. 200p. (AFWL-TR-65-43). CFSTI $5.00 cy, $1.25 mn.

An investigation to obtain experimental solutions to viscoelastic stress wave interaction problems pertinent to the design of protective structures is described. The methods of photoviscoelasticity and experimental viscoelasticity in general were employed. The model material used, plasticized polyvinyl chloride, was characterized mechanically and optically by creep tests at different temperatures using the temperature-time equivalence principal and by sinusoidal oscillation tests. Good agreement was obtained by the two methods of property determination. Photoviscoelastic plates were subjected to falling weight and air shock loadings. In the falling weight loading, stresses were determined on the boundary of a circular hole and at a similarly located point in the free field. It was found that the measured maximum compressive stress on the hole boundary is up to 17% higher than that obtained by using the free-field stresses and static stress concentration factors. In the air shock loading, stresses were determined at a free-field point and on the boundaries of circular hole and a rigid circular inclusion. The maximum compressive stress on the hole boundary is appreciably higher than the "statically" computed stress initially, but approaches it at later times. In the case of the rigid inclusion, differences of up to 25% between dynamic and "static" stresses were found. (auth)

**43496** (CEX-59.7B(Pt.1)) EXPERIMENTAL RADIATION MEASUREMENTS IN CONVENTIONAL STRUCTURES. PART I. RADIATION MEASUREMENTS IN TWO TWO-STORY AND THREE ONE-STORY TYPICAL RESIDENTIAL STRUCTURES BEFORE AND AFTER MODIFICATION. Burson, Z. G. (Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.). June 1963. Contract AT(29-1)-1183. 127p. Dep. mn. CFSTI $1.50 cy, $0.75 mn.

An experimental study designed to provide a basis for estimating protection against fallout radiation was performed on two two-story structures with basements and on three one-story structures without basements. These structures, located at the Nevada Test Site, were studied before and after modifications. An idealized fallout-radiation field was simulated with the use of the Mobile Radiological Measuring Unit. This unit used a sealed radioactive $^{60}$Co source that was pumped at a uniform speed through a long length of flexible tubing evenly distributed over the area of interest. Radiation levels at selected points inside the structures were measured with sensitive ionization-chamber detectors. The experiments were conducted simultaneously with an architectural-engineering study to develop and demonstrate practical means of improving fallout-radiation protection by economical modifications of existing typical houses. Experimental data were gathered at each house before and after shelters were constructed or modified. The effects of various practical modifications of the existent structures, such as adding transite panels to the walls, building planters, or adding baffle walls, were also considered. (auth)

## Space Propulsion

***See also*** **ISOTOPE TECHNOLOGY — Power Application**
**REACTOR TECHNOLOGY — Propulsion and Space**

**43497** (SAN-651-1) ORGANIC RANKINE CYCLE TECHNOLOGY PROGRAM. Quarterly Progress Report No. 1, February 15, 1966–June 30, 1966. Adam, A. Warren (Sundstrand Aviation-Rockford, Ill.). July 28, 1966. Contract AT(04-3)-651. 62p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Biphenyl and biphenyl ether working fluids for an organic Rankine cycle power conversion system capable of long duration operation in space were investigated. A configuration for the test loops, including the pumping system, was designed. Preliminary design of the heat rejection system was completed. Specifications for the procurement, handling, and analysis of the working fluids have been prepared. (F.S.)

## Vacuum Engineering

**43498** PRE-HEATED DIFFUSION PUMPS. Borovik, E. S.; Nikolaev, G. T.; Sharevskii, B. A. pp 105-13 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

Descriptions are given of the modifications and simplifications introduced in the construction of pre-heated diffusion pumps employing liquid hydrogen traps. Experiments were carried out with the pre-heated diffusion pumps using liquid helium instead of liquid hydrogen. The results indicated that at identical conditions a higher and a more stable vacuum can be achieved with liquid helium. Investigations with liquid helium are being continued. (R.V.J.)

**43499** ADSORPTION CAPACITY OF ZEOLITES AT PRESSURES FROM $1.10^{-3}$ TO $1.10^{4}$ $N/m^2$ AND LIQUID NITROGEN TEMPERATURE. Lunev, Z. M.; Romanov, A. A. pp 120-30 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

Internal diffusion is the decisive stage in the kinetics of hydrogen, nitrogen, and argon adsorption on granulated synthetic zeolites arranged in a thin layer and cooled to the temperature of liquid nitrogen. The process of filling the adsorption space to equilibrium values at constant concentration takes place over a protracted period of time with low adsorption rates. A study of the exchange of a sodium ion for cations of calcium and magnesium showed that MgNaA and CaNaA zeolites give the most complete degree of sodium ion exchange for magnesium or calcium cations in static vacuum systems. These zeolites give low pressures for carrying out experiments in clean conditions. By varying the degree of sodium ion exchange for other cations, the molecular sieve properties of the zeolites may be controlled within wide limits at low temperatures. In view of the low adsorption rates at low temperatures, the use of zeolites in dynamic vacuum systems is not very effective. (ATD)

# GEOLOGY, METEOROLOGY, AND MINERALOGY

## General

*Refer also to abstracts 43084–43087 and 43987.*

**43500** (COO–689-60) CORRELATION AND CHRONOLOGY OF ORE DEPOSITS AND VOLCANIC ROCKS. Annual Progress Report. Damon, Paul E. (Arizona Univ., Tucson. Geochemical Section). July 1, 1966. Contract AT(11-1)-689. 159p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

An attempt was made to relate research within the broad scope of the evolution of western North America during post-Turonian time. Developments in analysis of argon, potassium, rubidium, and strontium are discussed. Areal and topical studies were conducted on the Mesozoic rocks in the Sierrita Mountains, geochronology of the Dos Cabezas Mountains in Arizona, premid-Tertiary erosion surface, K–Ar dates for Cenozoic volcanic rocks, dating of Plio-Pleistocene volcanic rocks, Cenozoic-Mesozoic magnetic pulses, granites from Kabaing Batholithic Complex, Magok Area, Burma, and excess argon in minerals. Some trace research was conducted on the "Turkey Track" andesite chemical analysis. Papers and abstracts of papers on the individual topics are included as appendices. (F.S.)

**43501** (COO–689-60, App.A-1) CENOZOIC ARGON AGES ON METAMORPHIC ROCKS FROM THE BASIN AND RANGE PROVINCE. Mauger, Richard L.; Damon, Paul E.; Livingston, Donald E. (Arizona Univ., Tucson. Geochemical Section). 12p. (COO–689-61).

A number of mid-Tertiary K–Ar mineral ages have been reported from stratigraphically older metamorphic rocks in the Basin and Range Province. Within the Basin and Range Province the space-time congruency between mid-Tertiary magmatism and tectonism suggests that widespread crustal heating has occurred. As a result, minerals in many rocks older than mid-Tertiary in age have lost radiogenic argon to some degree. The "anomalous" mid-Tertiary K–Ar ages from older metamorphic rocks can be interpreted as cooling ages that record the time when the rocks were evaluated to a near-surface position within the crust. This interpretation was used by Damon et al. (1963) to explain the K–Ar results from the Catalina-Rincon Mountains, Arizona. Armstrong (1963) and Armstrong and Hansen (1966) attributed the mid-Tertiary ages on metamorphic rocks from localities in the Great Basin to final cooling following Tertiary uplift and erosion. (auth)

**43502** (COO–689-60, App.A-2) ISOTOPIC STUDIES IN THE ROSKRUGE MOUNTAINS, PIMA COUNTY, ARIZONA. Bikerman, Michael (Wichita State Univ., Kans.). 14p. (COO–689-59).

K–Ar dating of igneous rock units in the Roskruge Mountains, Pima County, Arizona, indicates that periodic activity occurred in mid-Cretaceous time, during the late Cretaceous—early Tertiary (Laramide) interval and in mid-Tertiary time. The oldest date (108 million yr) is from an andesite in the Cretaceous "basement" of the range. The Laramide ages (74–66 million yr) are on a series of ash flows and an associated pluton which give initial $^{87}$Sr/$^{86}$Sr ratios ranging from 0.706–0.709. The mid-Tertiary activity includes the emplacement of a small pluton at 34 million yr; the extrusion of basaltic andesites at 23 million yr (initial $^{87}$Sr/$^{86}$Sr ratio of 0.709) and the formation of a small well preserved ash flow sheet at 13 million yr (initial $^{87}$Sr/$^{86}$Sr ratio of 0.707). The latest known igneous activity in the range is represented by basalt dikes and a flow which are 10 million yr old and have initial $^{87}$Sr/$^{86}$Sr ratios of 0.704. (auth)

**43503** (COO–689-60, App.A-3) $^{40}$Ar IN COGENETIC FELDSPAR-MICA MINERAL ASSEMBLAGES. Livingston, Donald E.; Damon, Paul E.; Mauger, Richard L.; Bennett, Richmond; Laughlin, A. William (Arizona Univ., Tucson. Geochemical Section). 28p. (COO–689-62).

New data which permits comparison of K–Ar ages of cogenetic micas and feldspars from different geological environments is presented. The relations between these ages are also supported by data from the literature. The results of this investigation lead directly to the general problem of argon retentivity in different mineral phases from the same rock. Initial excess $^{40}$Ar is present in albite from pegmatites and in plagioclase-quartz separates and a potash feldspar from two early Tertiary plutons. The problems of initial excess argon and mineral retentivity involve environmental and petrogenetic as well as mineralogic factors. For a suite of cogenetic minerals, the differences in $^{40}$Ar/$^{40}$K can conveniently be compared with reference to an isochron plot with log $^{40}$Ar and log K as coordinate axes. (auth)

**43504** (COO–689-60, App.A-4) EXCESS RADIOGENIC ARGON IN MINERALS OF THE AMELIA, VIRGINIA PEGMATITES. Laughlin, A. W. (Arizona Univ., Tucson. Geochemical Section). 13p. (COO–689-63).

Potassium–argon age determinations were made on several minerals from the pegmatites near Amelia Court House, Virginia. Three muscovite ages agree well at 248 ± 4 million yr with previously published ages of 261–289 million yr by the Rb–Sr method. The analysis of a large zinnwaldite crystal yielded an age of 238 ± 7 million yr. Plagioclases consistently gave anomalously old ages. Analysis of clevelandite albite yielded an age of 384 ± 15 million yr. Blocky blue albite crystals were dated at 416 ± 21 million yr. Two samples of the chatoyant, moonstone variety of albite, which contained abundant fluid inclusions, yielded ages of 297 ± 9 and 352 ± 11 million yr. Using the mean muscovite age of 248 ± 4 million yr, the anomalous albite ages can be explained by excess radiogenic argon contents of $0.193-0.570 \times 10^{-10}$ mole/g. This value compares well with earlier work. One beryl sample showed an excess of $186.2 \times 10^{-10}$ mole/g or radiogenic argon. Perthitic microcline gave ages of 228 ± 7 and 212 ± 6 million yr, indicating some argon loss. Work is in progress to determine the quantity of excess argon held in fluid inclusions and to determine if albite from the perthite also contains excess radiogenic argon. (auth)

**43505** (COO–689-60, App.A-5) RELATIONSHIP BETWEEN TERRESTRIAL FACTORS AND CLIMATE. Damon, Paul E. (Arizona Univ., Tucson. Geochemical Section). 12p. (COO–689-64).

Fluctuations in climate and the rate of organic evolution with the pulsation of major and minor periods of mountain building and consequent oscillations of sea level are discussed. The present severely differentiated climate of the earth is abnormal as contrasted with the relatively mild, uniform normal climate existing during most of geologic time. The mild, uniform normal climates are the result of the ameliorating effect of relatively unimpeded circulation of the oceans and atmosphere. Major climatic variations are ascribed to large scale crustal warping (epeirogeny) and the minor fluctuations with mountain building (orogeny). The two processes act simultaneously but on different temporal and spatial scales. (R.C.K.)

**43506** (COO–689-60, App.A-6) RADIOACTIVE DATING OF QUATERNARY TEPHRA. Damon, Paul E. (Arizona Univ., Tucson. Geochemical Section). 9p. (COO–689-65).

Two methods of radioactive dating that have been applied to tephrochronology are the $^{14}$C method and the K–Ar method. The ultimate limit on the range of the $^{14}$C method is determined by the smallest quantity of $^{14}$C that can be extracted free of younger contamination and measured. Isotopic concentration allows for extension of the $^{14}$C method to 100,000 years, but the sensitivity of such old samples to contamination probably does not warrant the effort. The ultimate limitation on accuracy is provided by the constancy of the $^{14}$C concentration in the atmospheric reservoir. Results indicate that variations of up to 13% have occurred during the past 6,000 years. However, the relative error due to such fluctuations is inversely proportional to true sample age, and so a 13% fluctuation that results in a 17% age error at 6,000 years would only produce a 5% error at 20,000 years. The ultimate limitation on the range of K–Ar dating is provided by the precision of the correction for atmospheric $^{40}$Ar. This, plus the phenomenon of occlusion of excess initial radiogenic $^{40}$Ar during mineral genesis, is ample reason for skepticism concerning the possibility of extending the K–Ar method to ages now within the range of $^{14}$C dating. 1.5 to $12 \times 10^{-11}$ moles/gm of excess radiogenic $^{40}$Ar in plagioclase feldspar from hypabyssal igneous rocks have been measured. Assuming 99% efficient degassing of potash feldspar upon volcanic extrusion, such an excess would result in an error of 15,000 to 50,000 years. If the degassing is only 90% efficient, the error would be between 150,000 and 500,000 years. The accuracy of the K–Ar method for Quaternary dating has yet to be established. (auth)

**43507** (COO–689-60, App.A-7) GAMMA-RAY SPECTROMETER STUDIES OF HYDROTHERMALLY-ALTERED ROCKS (A DISCUSSION). Mauger, Richard L. (Arizona Univ., Tucson. Geochemical Section). 6p. (COO–689-66).

A discussion of a paper by R. M. Moxham, R. S. Foote, and C. M. Bunker entitled, "Gamma Spectrometer Studies of Hydrothermally-Altered Rocks" is presented (see NSA 19: 36656 for abstract). It was concluded that the results obtained by Moxham, Foote, and Bunker confirm the fact that potash is more abundant in the ore zone igneous rocks than in nearby unmineralized igneous rocks of the same age. (R.C.K.)

**43508** (NP–16179) STUDY OF THE PHYSICO-CHEMICAL-BIOLOGICAL PROCESSES AFFECTING THE DISPERSION OF RADIONUCLIDES. PART I AND II. Report No. 4(Final), January 12, 1961–January 12, 1964. Oren, O. H. (Ministry of Agriculture, Haifa (Israel). Sea Fisheries Research Station). Contract 118/RB. 158p. Dep. mn.

Results are summarized from studies on biological, chemical, and physical processes that may affect the distribution of radionuclides in the eastern Mediterranean Sea, with emphasis on the Levantin Basin and the coastal area of Israel. The Nile River is the only source of fresh water and nutrients in the area, and the influence of seasonal flooding of the Nile River was studied. Data are presented on the temperature, salinity, and silicate, calcium, and magnesium contents of the water in various seasons of the year. Data are also included on nutrient content, food chains of phytoplankton, zooplankton, benthic micro- and macro-communities, fish of economic importance, and on primary production as measured by the $^{14}$C method, and on meteorological and solar factors affecting primary production in the eastern Mediterranean Sea. (C.H.)

**43509** OXYGEN ISOTOPE ENRICHMENT OF SEA WATER BY EVAPORATION. Lloyd, R. M. (Shell Development Co., Houston, Tex.). Geochim. Cosmochim. Acta, 30: 801-14(Aug. 1966).

An evaporation mechanism proposed by Sverdrup is used as a model to interpret the changes in isotopic composition that occur during the evaporation of sea water. The relative humidity at the site of evaporation is shown to be an important factor in determining the net isotopic enrichment, especially at very high salinities. From these results it is proposed as a working hypothesis that brines originating by evaporation of sea water in a humid coastal environment will attain $\delta^{18}$O values no higher than 6%. (auth)

## Meteorology

### See also Site Survey and Selection

**43510** (RM–4989-TAB) THE EFFECTS OF NUCLEAR WAR ON THE WEATHER AND CLIMATE. Batten, E. S. (RAND Corp., Santa Monica, Calif.). Aug. 1966. Contract AT(04-3)-414. 63p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

The possibility that the energy, the debris, or the radioactivity of nuclear detonations in large number may affect the climate and the weather is explored. Because of the complexity and the lack of thorough understanding of the interdependent meteorological processes, it is impossible today to predict the consequences of artificial atmospheric stimuli. The ways that the by-products of a nuclear war may interfere with the dynamical, hydrological, and radiational processes in the atmosphere are explored. The difficult problems of estimating quantitatively the weather and climatic changes are avoided except to emphasize the ambiguities of such estimates. It was concluded that the interference with the atmospheric processes in some cases can be sufficient to produce changes in them; however, it was stressed that the nature, extent, and magnitude of the resulting anomalies in the weather and the climate are uncertain. (auth)

**43511** OXYGEN ISOTOPE STUDIES OF IVORY COAST TEKTITES AND IMPACTITE GLASS FROM THE BOSUMTWI CRATER, GHANA. Taylor, Hugh P. Jr.; Epstein, Samuel (California Inst. of Tech., Pasadena). Science, 153: 173-5(July 8, 1966).

Oxygen isotope analyses were obtained for six Ivory Coast tektites, two samples of Bosumtwi Crater glass, and two new moldavites. The Ivory Coast tektites are 2 to 5 per mill richer in oxygen-18 than other known tektites, and they are similar in oxygen-18 content to the impactite glass from the nearby Bosumtwi Crater. These data are compatible with a terrestrial origin for the Ivory Coast tektites. (auth)

## Natural Radioactivity and Fallout

### See also HEALTH AND SAFETY

*Refer also to abstracts 43598 and 45227.*

**43512** (ANL–7136, pp 315-27) ENVIRONMENTAL RADIATION STUDIES. (Argonne National Lab., Ill.).

Progress is reported on investigations of the levels of fission product and natural radioactivity present in the Chicago environment and the dose to the population arising from it. Data are presented on the content of $^{137}$Cs in surface air, precipitation, soil, milk, other foods, and total diet during 1965; and the dynamic processes in the freshwater ecosystem that lead to relatively high concentrations of $^{137}$Cs in fish. The development of balloon-borne scintillation counters for the location of radioactive nuclear debris in the upper atmosphere is discussed. A program for the GE 225 computer was written for use in the analysis of complex gamma spectra from exposed air filters, soil samples, and other media. Chemical procedures are described for the determination of $^{7}$Be, $^{109}$Cd, $^{210}$Po, and $^{210}$Pb in air filter samples. A potentiostat was designed to automatically maintain the potential of a working electrode constant at any set value. A circuit diagram is presented and applications in the constant-potential electrodeposition of $^{210}$Pb, $^{109}$Cd, and $^{125}$Sb collected on air filters are discussed. (C.H.)

**43513** (CEX–59.4.26) AERORADIOACTIVITY SURVEY AND AREAL GEOLOGY OF THE DENVER AREA, COLORADO (ARMS-I). Popenoe, Peter (Geological Survey, Washington, D. C. Division of Biology and Medicine (AEC), Washington, D. C.). Apr. 1964. 26p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

An airborne gamma-radiation survey of 6500 square miles near Denver, Colo., was made by the U. S. Geological Survey for the U. S. Atomic Energy Commission. Continuous radioactivity profiles were obtained with scintillation detection equipment installed in a twin-engine aircraft. The area was traversed with parallel east-west flight lines spaced at one mile intervals and flown 500 ft above the ground. A map of radioactivity units was prepared from the profiles. Results of the survey indicate a wide range of natural radioactivity exists and that its general distribution can be attributed to the geology of the area. All of the area surveyed lies in the Colorado Piedmont section of the Great Plains physiographic province which is underlain by Paleozoic, Mesozoic, and Cenozoic sedimentary rocks and Quaternary surficial deposits. High radioactivity levels are generally associated with arkosic and conglomeratic sedimentary rocks and alluvium derived from the crystalline rocks of the Front Range. Lower levels are associated with argillaceous and arenaceous sedimentary rocks, and eolian sand and loess. (auth)

**43514** (UCRL–16878) RADIOACTIVITY OF CEMENT RAW MATERIALS. **Wollenberg, Harold A.; Smith, Alan R. (Lawrence Radiation Lab., Univ. of California, Berkeley). May 1966. Contract W-7405-eng-48. 31p. (CONF-660329–1). Dep. mn. CFSTI $2.00 cy, $0.75 mn.**

**From Geology of Industrial Minerals, 2nd Annual Midwest Forum, Bloomington, Ind.**

In choosing concrete ingredients for low-background radiation shielding, we studied the concentration of the natural radioisotopes U, Th, and K in raw materials from California and British Columbia cement plants. Samples of portland cement from the plants in California and elsewhere in the U. S. and Canada were also analyzed for radioactivity. Analyses were performed by gamma-ray spectroscopy. Results of the raw materials study indicate that limestone is the least radioactive major ingredient in cement and sources of alumina and silica (shale) are appreciably higher in radioactivity. Uranium is the major contributor to the radioactivity of limestone and Th predominates in shale. (auth)

**43515** (AEC-tr–6798) USSR REPORTS ON FALLOUT OVER THE OCEANS. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR). Translated for New York Operations Office, Health and Safety Lab., N. Y. 54p. **Dep. mn. CFSTI $3.00 cy, $0.50 mn. JCL $5.60 fs, $1.82 mf.**

Three papers on global fallout are presented. Separate abstracts were prepared for two papers: the remaining paper is reported in NSA as 20: 31421. (H.G.D.)

*For abstracts of individual papers see: 43516 and 43517.*

**43516** (AEC-tr–6798, Paper 1) BASIC FEATURES OF THE GLOBAL $^{90}$Sr DISTRIBUTION ON THE SURFACE OF THE WORLD'S OCEANS (1960–1961). Popov, N. I.; Lopatin, S. A. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR). 20p.

Surface effects are discussed as affecting spotty strontium-90 distribution in the oceans and seas worldwide. Data for 1954 to 1961 are used to illustrate the spreading mechanisms of fallout. (R.E.U.)

**43517** (AEC-tr–6798, Paper 2) EVALUATION OF THE TOTAL QUANTITY OF $^{90}$Sr IN THE WORLD OCEAN. Popov, N. I. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR). 10p.

Strontium-90 reserves were estimated for all oceans from data collected in the Atlantic, Pacific, and Indian Oceans. It is assumed that the main $^{90}$Sr mass on the globe is located in the oceans because they occupy an overwhelming portion of the earth's surface, and thus contain a major portion of the total world fallout and because a large number of nuclear explosions have been in the atmosphere above the ocean and under the surface of the ocean. Within the limits of the investigated ocean areas, the $^{90}$Sr content amounted to approximately 10 MC. This estimate is compared to estimates derived from other data. (H.G.D.)

**43518** (NSJ-tr–54) OBSERVATIONS OF FALLOUT IN TOKYO. II. DETERMINATION OF $^{90}$Sr AND $^{137}$Cs IN RAIN WATER, VEGETABLES, AND SOILS IN MIYAKE-JIMA. **Suzuki, Hamaji; Ito, Nobuo; Suzuki, Osamu; Meshitsuka, Gisuke. Translated from Tokyo Metrop. Isotop. Centre Ann. Rep., 2: 87-91(1963). 6p. Dep. mn. JCL $1.10 fs, $0.80 mf. JAERI.**

Radioactive contamination of drinking water in Izu islands (Tokyo) is one of the serious problems of environmental contamination due to nuclear explosion experiments. Miyake-Jima is one of Izu islands, where they use rain water as drinking water. The $^{90}$Sr and $^{137}$Cs contents in rain water were determined in 1960 and 1961 and the results were 2.08 to 7.26 $\mu\mu$C/l, and 1.47 to 6.30 $\mu\mu$C/l, respectively. These values were 10 to 100 times higher than those of tap and well water in other places. The $^{90}$Sr and $^{137}$Cs contents in vegetables and soils were also determined for a comparison of locality. The results were 15.2 to 140.2 $\mu\mu$C $^{90}$Sr/kg fresh and 13.4 to 64.7 $\mu\mu$C $^{137}$Cs/kg fresh for vegetables and 5.6 to 41.2 mC $^{90}$Sr/km$^2$ and 12.8 to 63.8 mC $^{137}$Cs/km$^2$ for soil. The results showed no significant differences in locality. Radioactive environmental contaminations in Miyake-Jima was observed in drinking water only. (auth)

**43519** SEVENTH REPORT OF THE FEDERAL COMMISSION FOR THE MONITORING OF RADIOACTIVITY PRESENTED TO THE FEDERAL COUNCIL FOR THE YEAR 1963. **Huber, P. Bull. Eidgenoss. Gesundh., Beil. B., 22: No. 4, 1-88(Aug. 1964). (In German).**

Data from fallout monitoring stations in Switzerland are presented in the form of graphs and tables which show the distribution of active particles in air, precipitation, cistern water, and sludge; and the radioactivity levels in surface, ground, and waste waters; plankton, sediment, aqueous plants, and fish; grass, hay, soil, and food; and in the human body. (J.S.R.)

**43520** TRANSITIONS OF $^{90}$Sr AND $^{137}$Cs CONCENTRATIONS IN MILK. PART II. Danbara, Hiroshi; Mitsuhashi, Toshihiko (National Inst. of Animal Industry, Chiba, Japan). Chikusan Shikenio Kenkyu Hokoku, No. 7, 7-12(Oct. 1964). (In Japanese).

Concentrations of $^{90}$Sr and $^{137}$Cs in milk produced in several districts in Japan were determined for the period from November 1962 to September 1963. The concentration of $^{90}$Sr in milk obtained increased gradually after March and through June and July. The concentration of $^{137}$Cs in milk in this period was higher than that in the previous period, and its transition tendency was almost the same as that of $^{90}$Sr. The concentration of milk with these radionuclides was also found to vary geographically. The data showed that the concentration of $^{90}$Sr was higher throughout the period in milk produced in the northern and northeastern districts of Japan and was higher than that in the southwestern districts including Kanto area of Japan. (TCO)

**43521** LEAD ISOTOPES AND VOLCANIC MAGMAS. Cooper, J. A.; Richards, J. R. (Australian National Univ., Canberra). Earth Planet. Sci. Lett., 1: 259-69(Sept. 1966).

Lead isotope measurements on 25 modern volcanic extrusives (Hawaiian Islands 18, Japan 5, Reunion Island 2) indicate a complicated geological history. Attempts have been made to evaluate this by assuming that the source region may be considered as a single entity; i.e., that all modern volcanoes may be treated as one related group. Geometrical syntheses have been made of the field limits of scatter patterns to be expected on a $^{207}$Pb/$^{204}$Pb–$^{206}$Pb/$^{204}$Pb graph for various assumed geological histories. Comparison of these models with the experimental results indicates that: (1) On the scale appropriate to the production of volcanic magmas the upper mantle had either (a) a homogeneous U/Pb ratio up to a time $t_1$, or (b) a heterogeneous U/Pb ratio that was completely homogenized on a world-wide scale at the time $t_1$, (2) Time $t_1$ was probably about 2,800 million yr ago. This figure is an approximate estimate that will improve as more measurements are made, (3) The wide scatter of Pb isotope ratios in modern volcanics is primarily due to processes of heterogeneous redistribution of U and Pb in the source region at about five discrete times between 2,800 million yr and the present day, (4) This source region has also undergone an overall increase of about 20%. It is not possible to discern whether these figures truly represent a single event at around 1,500 million yr ago, or the average of a number of events between about 2,800 million yr and the present, but the latter case seems more likely. These events would then coincide with the times of heterogeneous redistribution, and (5) The Th/U ratio of the source of the volcanics is close to 4. (auth)

**43522** INVESTIGATION OF THE DECONTAMINATION EFFICIENCY OF SLOW SAND FILTER ACTION IN GROUND WATER RECHARGE. **Frank, Willy H.; Hagel, Guenther V.** Gas- Wasserfach, 105: 1400-3(Dec. 11, 1964).

Fission products from fallout can be removed to the extent of 75 to 95% by artificial ground recharge if the final seepage of the surface water is preceded by filtration. The degree of decontamination depends on the degree of natural water activity. About 99% of the radionuclides, which can be eliminated from the surface water by slow filtration, are stopped in the upper 5 cm of a sand filter layer. The 2-stage slow filtration possesses a higher average efficiency for radioactive fission product mixtures that can be obtained by hydroxide precipitation with the use of Fe and Al salts and subsequent rapid sand filtration. (Public Health Eng. Abstr., 45: No. 7(July 1965))

**43523** MONITORING SURFACE WATER FOR RADIOACTIVE SUBSTANCES BY CONTINUOUS SAMPLING. **Aurand, Karl.** Gas-Wasserfach, 106: 676-9(1965). (In German).

In the monitoring of surface waters for radioactive materials, knowledge of the mean concentration over a long period is important for radiobiological evaluation. Continuous sampling is a simple method for the determination of mean concentration. From 1962 to 1964 the mean concentrations of radioactive materials in surface waters were determined for 14-day time intervals in Berlin using a continuous sampling device. The method makes it possible to detect separately the activity fraction bound to sedimentary materials. The results show that the ratio between dissolved and undissolved activity fractions underlie some accidental errors and up to 50% of the activity can be bound to sedimentary material. The development of an improved continuous sampling device (swimmer sampler) is reported. (tr-auth)

**43524** STUDY OF NUCLEAR DEBRIS IN THE UPPER ATMOSPHERE. **Edvarson, K.; Loew, Kerstin** (Research Inst. of National Defense, Stockholm). Health Phys., 12: 1275-82(Sept. 1966).

A method to determine the time of origin and relative contribution of the different components in debris from nuclear explosions is described. The method is applied to a number of samples taken over Sweden in Autumn 1962 to Spring 1963. (auth)

**43525** MEASUREMENT OF AIRBORNE ACTIVE DEPOSIT FROM $^{22}$Rn (THORON). **Behounek, F.; Fiser, B.** (Technical Univ., Prague. Nuclear Research Inst., Prague). Health Phys., 12: 1307-10(Sept. 1966).

A simple routine method for the determination of the airborne active deposit from $^{220}$Rn has been worked out. It is based on the use of a solid $ThO_2$-standard and on the counting of $\beta$ particles. (auth)

**43526** REVIEW OF APERTURE AND CEILING-SHINE EFFECTS IN FALLOUT SHIELDING TECHNOLOGY. **Chilton, Arthur B.** (Univ. of Illinois, Urbana). Health Phys., 12: 1311-16(Sept. 1966).

A review of the existing methods of predicting aperture and ceiling-shine effects in fallout shielding technology, indicates the extent to which the techniques used are well supported by research. The present methods of handling apertures appear quite plausible, but no confirmatory work is yet available. The method of accounting for ceiling-shine presently used is somewhat artificial and under some circumstances a more precise method is needed. Such improved methods have been suggested, but there is still room for further careful study of this problem. (auth)

**43527** $^{137}$Cs IN BROMUS TECTORUM L. IN RELATION TO PRECIPITATION REGIMES AND HARVEST YIELDS. **Rickard, W. H.** (Battelle-Northwest, Richland, Wash.). Contract AT(45-1)-1830. J. Range Manage., 18: 343(1965).

The grass, downy brome (Bromus tectorum), was harvested from an abandoned field on the Hanford Reservation, Washington, in May, 1963 and 1964, when plants were mature but before loss of seeds. Radiochemical analyses were made by gamma spectrometry. Precipitation data for the growing seasons 1962–63 and 1963–64 are given. The precipitation was very heavy during 1962–63, but the 1963–64 season was extremely dry. The abundant precipitation contributed to the yield of downy brome but not to increased concentrations of cesium-137. Although cesium-137 accumulates in soil, there is little absorption by grasses because of the strong affinity of soil colloids for cesium-137. Spring sampling is a means of estimating the annual increment of worldwide fallout deposited over annual grass pastures. (H.L.W.)

**43528** RADIOACTIVE FALLOUT PARTICLES FROM THE CHINESE NUCLEAR EXPLOSION TEST. PART 2. **Mamuro, Tetsuo** (Radiation Center of Osaka Prefecture, Japan). Mizushori Gijutsu, 6: No. 9, 15-20(Sept. 1965). (In Japanese).

A study was made of the fractionation effect on the radiochemical components of large particles produced in the Chinese nuclear explosion test. The fractionation effect in the Chinese test was different from that in Russian tests; the Chinese particles were of two opposite fractionation types. Particles which underwent the first type of fractionation (similar to Russian particles) showed unusually high $^{95}$Zr + $^{95}$Nb contents and low $^{103}$Ru contents. The particles which underwent the second type of fractionation, on the other hand, showed relatively high contents of $^{103}$Ru and low contents of $^{95}$Zr + $^{95}$Nb. The latter type was found in the Russian particles. Assuming that the Chinese detonation was a thermal neutron reaction using $^{235}$U, the fractionation factor was calculated for various particles. Most of the particles having strong activities were found to have undergone the second type of fractionation. This difference in the fractionation behavior of the Chinese and Russian particles may be attributed to the fact that the Chinese particles were produced in a small detonation near the earth's surface, whereas the Russian particles were produced in a large detonation in the air. (NSA of Japan)

**43529** RADIUM CONTENT OF RAINWATER. **Banerji, Partha; Chatterjee, S. D.** (Jadavpur Univ., Calcutta). Nature, 211, 511-12(July 30, 1966).

The radium content of about 50 samples of rain water collected in Calcutta, India was measured. In order to avoid contamination, the samples were treated with pure calcium chloride and sodium potassium carbonate, so that radium if present, would be coprecipitated with calcium carbonate. The radium content of the samples was measured with a differential ion chamber. The maximum radium content recorded was $1.5 \times 10^{-12}$ C/l. When continuous rainfall occurred, in most cases the last portion contained negligible activity ($<10^{-14}$ C/l). (F.S.)

**43530** STUDIES IN RADIOACTIVE FALLOUT IN NEW ZEALAND. III. ISOTOPE DETERMINATIONS ON ASHED RAINWATERS (Sept. 1956 TO June 1959). **McNaughton, G. S.; Woodward, R. N.** New Zeal. J. Sci., 8: No. 2, 228-52(June 1965).

The fission products $^{90}$Sr, $^{137}$Cs and $^{144}$Ce were measured in ashed monthly rainwater samples collected at Auckland, New Zealand, in the period May 1957 to June 1959. Five fresh waves of radioactivity were identified by increases in the total $\beta/^{90}$Sr ratio, the $^{144}$Ce/$^{90}$Sr ratio, and from earlier work on the rate of $\beta$-decay of the samples. On the assumption that the time of origin of the youngest debris arriving in each of these waves of radioactivity was known, the percentages of $^{90}$Sr contributed by this debris were calculated for each sample, both from the total $\beta/^{90}$Sr ratios and from the $^{144}$Ce/$^{90}$Sr ratios. It is considered that the former method is more reliable for the samples discussed here. Although $^{90}$Sr may appear from U.S. and U.K. Pacific tests in the month testing starts, the main increase in New Zealand occurs 3–6 months later. The great number of closely spaced tests during the testing period has usually prevented the calculation of $^{90}$Sr depositions from any specific test for periods longer than a few months. No fresh evidence for the presence of U.S.S.R. debris is presented, but calculated upper limits for the amount of $^{90}$Sr from this source is given for some samples. (auth)

**43531** INVESTIGATIONS ON THE ISOTOPIC COMPOSITION OF WATER FROM TARNOBRZEG BASIN.

Selecki, Anatol; Graczyk (Inst. of Nuclear Research, Warsaw). Nukleonika, 11: 339-43(1966). (In Polish).

The isotopic composition of water samples from Tarnobrzeg sulphur mines was determined. It was found that it does not differ from the isotopic composition of surface waters. The flotation method used for measurements is described and its accuracy estimated. (auth)

**43532** RADIOCHEMICAL DETERMINATION OF $^{90}$Sr AND $^{137}$Cs IN DRINKING WATER AND MILK IN BOMBAY. Chandrasekaran, V. R.; Lalit, B. Y. (Atomic Energy Establishment, Trombay, India). pp 20-6 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Measurement of $^{137}$Cs and $^{90}$Sr in drinking water and milk in Bombay was studied by low-level beta-counting technique after chemical separation. A blank value was established using strontium, yttrium, and cesium carriers and amounted to less than 10% of the weakest activity measured. Yttrium recoveries rarely exceeded 30 to 40%. Data for fallout during 1964 through 1965 were compared using ion exchange versus ashing and precipitation techniques. The cation exchange-resin volume had to be 250 ml to prevent overloading of the anion exchange column by calcium. Warming the milk before analysis helped attain practical flow rates. (P.C.S.)

**43533** BACKGROUND RADIATION IN THE ROORKEE AREA. Christie, G. L.; Saraswat, I. P. (Roorkee Univ., India). pp 184-8 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A surface sample of sand was analyzed from the banks of the Solani River near Roorkee University, which was the source of the mortar sand used in the university buildings. Activity of the sand was due to the presence of uranium with its daughters and spontaneous fission products. About 2/3 of the activity was confined to particles of mesh size-100 and in the smaller mesh size; the −240 + 300 fraction contained the maximum activity. (P.C.S.)

**43534** ON THE STUDY OF THE UPTAKE OF STRONTIUM TRACER ($^{89}$Sr AND $^{90}$Sr) BY CALCIUM SULPHATE AND ITS ROLE IN IMPORTANT MORPHOLOGICAL AND GEOCHEMICAL STUDIES. Purkayastha, B. C.; Chatterjee, Anita (Saha Inst. of Nuclear Physics, Calcutta). pp 337-43 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Distribution coefficients for strontium tracer in gypsum, and anhydrite forms of calcium sulfate were studied at 0 to 80°C. Extent of uptake in anhydrite was much lower than in gypsum, although both forms take up strontium through mixed crystal formation, and obey both heterogeneous and homogeneous distribution laws. The low partition values are concluded to answer the question why Sr : Ca ratio is greater in seawater than it is in land. Studies of the partition values always produced values far below unity. Separation of calcium as sulfate from seawater in any morphological form becomes the cause of enrichment of seawater in strontium. (P.C.S.)

**43535** DISTRIBUTION OF THORIUM ISOTOPES BETWEEN THE PARTICLES OF VARIOUS DEGREE OF DISPERSION IN NATURAL WATERS. Dementev, V. S.; Syromyatnikov, N. G. Radiokhimiya, 7: 710-17(1965). (In Russian).

The behavior and forms of occurrence of thorium isotopes ($^{232}$Th, $^{228}$Th, $^{230}$Th, and $^{234}$Th) in granite water springs were investigated. Filtration, centrifugation, dialysis, and coagulation methods were used to establish the forms of occurrence. The wide polydispersion of the form of Th transport was established from the kinetics of the unstable crude dispersions up to the ion form. At the limits of the dispersion the condition was characterized by a nonhomogeneous distribution of the isotopes. It was established that the colloidal form of transport of thorium isotopes have preferentially a negative sign for the charged particles. The inhomogeneous condition of the thorium isotopes is a function of the radiologic properties of the isotopes and the conditions of their collisions in water. (tr-auth)

**43536** GROSS BETA RADIOACTIVITY IN SAMPLES OF PLANKTON COLLECTED FROM THE ADRIATIC AND LIGURIAN-TYRRHENIAN SEAS DURING THE PERIOD 1961–1964. Triulzi, Cesare; Tassi-Pelati, Laura. Rend. 1st. Lombardo Sci. Lett., B, 99: 121-32(1965). (In Italian).

Gross beta radioactivity was measured on plankton ash samples collected in the Ligurian-Tyrrhenian sea and upper Adriatic during 1961–1964. The trend of gross beta radioactivity during this period is correlated with rainfall and radioactive fallout in the same zone. Values of gross beta are reported, which were measured 15 and 200 days after the tow. The ratio between these values supplied a useful indication of the date of nuclear explosions responsible for sample contamination. (auth)

**43537** DECONTAMINATION OF MILK CONTAMINATED WITH RADIOACTIVE SUBSTANCES. De Ruig, W. G. Veeteelt Zuivelber., 7: 473-83(1964).

Ion exchange, calcium phosphate, and electrodialysis methods of $^{90}$Sr removal from milk are described. (Public Health Eng. Abstr., 45: No. 7(July 1965))

**43538** THE STATE OF THE $^{90}$Sr CONTAMINATION IN THE AREA OF THE GERMAN DEMOCRATIC REPUBLIC. Schilling, G. Wiss. Z. Friedrich-Schiller-Univ. Jena, Math.-Naturwiss. Reihe, 14: 129-32(1965). (In German).

The $^{90}$Sr contamination was investigated in various plants in 1961 and 1963. An increase from 65 pc $^{90}$Sr/Ca in 1961 to 245 pc $^{90}$Sr/Ca in 1963 was found. The origin of the significant deviations found in the 2 years was shown. On the basis of the contamination found, the degree of danger was evaluated on the basis of the maximum permissible concentration of 100 pc $^{90}$Sr/Ca in bones. In 1961 13% of the maximum permissible dose was reached in plant food and 3.2% in animal food; in 1963 49% of the maximum permissible concentration was reached in plant food and 12% in animal food. These figures show that the population was not endangered by $^{90}$Sr contamination. The situation after the enactment of the nuclear test ban treaty is discussed. (tr-auth)

**43539** DETERMINATION OF THE RATE OF RADIOACTIVE CONTAMINATION OF THE BLACK SEA. Belyaev, V. I.; Kolesnikov, A. G.; Nelepo, B. A. (Marine Hydrophysics Inst., Sevastopol). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/22, 20p. (In Russian). (CONF-660507-14). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

In 1964 extensive research was begun on the radioactivity of the waters of the Black Sea from the surface to the bottom. Results of $^{90}$Sr determination showed that the concentrations exceed those in the Atlantic Ocean. The depth distribution of $^{90}$Sr indicates considerable penetration of the radionuclide to the very lowest depths. In the Bosphorus area the specific $^{90}$Sr activity recorded at the bottom exceeded that on the surface. Following the detection of $^{90}$Sr at great depths calculations were made of its rate of diffusion from the surface towards the bottom. For this the turbulent diffusion equation was used in its usual form, i.e., taking account of the fact that vertical transport occurs as a result both of turbulent diffusion and of the vertical components of the mean current speeds, with the effects of $^{90}$Sr decay and absorption on biological substances also being considered. For purposes of the calculations, depth distribution curves, coefficients of turbulent diffusion, and vertical components of the mean current speeds, were derived from the data brought back by expeditions. The calculations were carried out with the aid of an electronic computer. A comparison was made between the calculated results and the observed depth distribution of $^{90}$Sr in the Black Sea. It was established that during ten years (the calculations were carried out between 1954 and 1964) surface contamination had penetrated to the bottom. (auth)

**43540** CONTAMINATION OF THE ATLANTIC OCEAN AND ADJOINING SEAS BY LONG-LIVED RADIONUCLIDES ACCORDING TO OBSERVATIONS DURING 1963–1964. Vdovenko, V. M.; Kolesnikov, A. G.; Gedeonov, L. I.; (and others) (Radium Inst., Leningrad. Marine Hydrophysics Inst., Sevastopol). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/24, 20p. (In Russian). (CONF-660507–15). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

Results of investigations on the content of $^{90}$Sr and $^{137}$Cs in the Atlantic Ocean and adjoining seas, carried out from the Soviet research ship "Mikhail Lomonosov" in 1963–64 are reported. The method of joint concentration was used for determination of $^{90}$Sr and $^{137}$Cs. The results of analysis of over 150 samples of sea and ocean water taken both from the surface and from various depths down to 2000 m are presented. Normally the contamination of the Atlantic Ocean is governed by the total fallout of atmospheric activity. Observations carried out showed that the distribution of $^{90}$Sr and $^{137}$Cs in the surface waters of the Atlantic at various latitudes differs considerably from the distribution, by latitude, of atmospheric fallout. An increase in the concentration of $^{90}$Sr and $^{137}$Cs in the equatorial zones of the Atlantic, i.e., in an area of low atmospheric fallout, was noted. This redistribution appeared to be promoted by ocean currents and the movement of water bodies in depth. The $^{90}$Sr and $^{137}$Cs contents in the surface layers of the Mediterranean were found to be double those obtained in the Atlantic at the same latitudes. The contents of these nuclides in the Black Sea were higher still, 4 times the level in the Atlantic at the same latitudes. On the basis of data on the depth distribution of $^{90}$Sr and $^{137}$Cs the amounts of these nuclides in the ocean were estimated and shown to be considerably greater than those existing on land. The $^{137}$Cs/$^{90}$Sr ratio amounted to 1.8. Thus, under oceanic conditions no separation of $^{90}$Sr or $^{137}$Cs is observed. In 1963 extremely high concentrations of $^{90}$Sr and $^{137}$Cs were detected in the equatorial zone of the Atlantic, exceeding the mean Atlantic level by a factor of 5 to 6, and by a factor of 14 at a depth of 1000 m. This concentration cannot be explained by reference to atmospheric sources of contamination. (auth)

**43541** SOME DATA ON THE DIFFUSION OF SOLUBLE CONTAMINANTS IN THE OCEAN. Ozmidov, R. V.; Popov, N. I. (Inst. of Oceanography, Moscow). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/25, 14p. (In Russian). (CONF-660507–16). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

The local contamination of ocean water by soluble materials, including long-lived radioactive isotopes, represents a potential threat of contamination to any other region of the ocean due to the transport of the contaminants along with the movement of water bodies. Some information on the transport processes of contaminants under actual oceanic conditions was obtained from data on the distribution in the seas and oceans of the world of one particular product of nuclear explosions, $^{90}$Sr. Throughout the whole period of contamination the surface waters of the Pacific and Atlantic Oceans consistently showed a difference in contamination level between the northern and southern hemispheres, caused by the greater density of atmospheric fallout of $^{90}$Sr in the northern hemisphere. This indicates a relatively slow exchange of surface water across the equator. Observations of $^{90}$Sr concentrations in surface waters of the North Atlantic showed that, in the period 1955–61, the concentration no more than doubled, whereas the cumulative fallout of $^{90}$Sr per unit of dry land, in the same latitudes and during the same period, increased 20 times. These data indicate an intense vertical turnover of water in the ocean bringing about the rapid "evacuation" of the contaminating substances from the upper layers. Data presently available on the distribution of $^{90}$Sr in the deep layers of the Atlantic Ocean make it possible to infer only very general trends regarding the vertical transport of soluble contaminants entering the ocean from the surface. In order to calculate a distribution of contaminant that will represent an average for the ocean as a whole (or for a considerable part of it), a simple vertical transport equation with a constant coefficient of turbulent diffusion and a zero mean vertical rate of movement of the ocean water is normally used. The chief peculiarity of the vertical transport process of $^{90}$Sr in the ocean consists of a sudden "inclusion" of an approximately constant inflow of previously absent contaminant. This peculiarity is taken into account by the appropriate boundary conditions on the ocean surface and a zero initial condition for the vertical transport equation relating to the isotope. When the equation is solved on these terms, it can be concluded, and confirmed from observational data, that the change in the $^{90}$Sr concentration in the surface layers of the ocean is proportional to the square root of the time elapsed since the beginning of global fallout (1954). The calculated curves for the vertical distribution of the isotope in the ocean are also in good agreement with observational data. Comparison of these data with theoretical values yielded a mean value for the coefficient of turbulent diffusion (30 cm$^2$/sec). (auth)

**43542** LABORATORY INVESTIGATIONS OF THE GAMMA-RAY SPECTRAL REGION FOR REMOTE DETERMINATION OF SOIL TRAFFICABILITY CONDITIONS. Williamson, A. N. (Army Engineer Waterways Experiment Station, Vicksburg, Miss.). 11p. (CONF-660417–1). ORAU. Gmelin, AED-CONF-66-076-1.

From 4th Symposium on Remote Sensing of Environment, Ann Arbor, Mich.

Gamma radiation from soil samples was measured, and the results were analyzed to evaluate the use of gamma rays in remotely determining soil parameters useful in estimating trafficability. Gamma spectra were obtained from representative samples of sand, silt, and clay placed in a low-background inclosure. Photopeak counting rates and photopeak ratios of thorium, uranium, and potassium were considered in the analysis. Results indicated that photopeak counts of the radioisotopes of primary interest were proportional to moisture content of the soil samples, but ratios of the photopeaks were nearly independent of moisture content, although different for each soil tested. Gamma measurements were also made on soil samples obtained from all 50 states in an attempt to correlate the ratios of their photopeaks of thorium, uranium, and potassium with soil type and other morphological, genetic, and physical-chemical characteristics of the soils. (auth)

**43543** MEASUREMENTS OF $^{220}$Rn (THORON) IN THE ATMOSPHERE BELOW 50 cm. Crozier, W. D.; Biles, Norman (New Mexico Inst. of Mining and Tech., Socorro). 19p. (CONF-660401–4). ORAU. Gmelin, AED-CONF-66-061-13.

From American Meteorological Society, American Geophysical Union, Annual Joint Meeting, Washington, D. C.

Direct measurements of $^{220}$Rn were made from the ground surface to a height of 50 cm, using apparatus adapted from that of G. W. Israël. Activity profiles are similar to those calculated by Jacobi and André and by Wormell, supporting the assumption that in the 50-cm height range a linear increase of diffusivity with height properly describes the turbulent diffusion of radioactive emanations from the soil surface, at least for turbulence of moderate intensity. The maximum activity at ground level, as expected, occurs at night during intervals of very low wind speed; it reaches values 75 to 150 times as high as the typical activities at 50 cm and 1 m. The $^{220}$Rn flux through the soil surface at the site measured seemed to be approximately $2.1 \times 10^{-15}$ C cm$^{-2}$ sec$^{-1}$ or 0.006 atoms cm$^{-2}$ sec$^{-1}$. The activities of $^{220}$Rn plus $^{216}$Po observed under conditions of very low turbulent diffusion are capable of yielding an ion production rate of about 250 ion pairs cm$^{-3}$ sec$^{-1}$ in the lowest 10 cm of the atmosphere over appreciable time intervals; this seems adequate to explain the presence of the shallow stratum of relatively high space charge density previously reported to exist under these conditions. (auth)

**43544** IMPORTANCE OF MUD AND SUSPENDED MATTER IN THE TRANSPORT AND ELIMINATION OF RADIONUCLIDES CONTAINED IN SURFACE WATERS.

Juguet, B. (Laboratoire d'Hygiene de la Ville, Paris); Donner, M.; Coin, L.; Burg, C. Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/7, 14p. (In French). (CONF-660507-7). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

Natural radioisotopes present in surface waters and those which have been added by human activities, such as fallout and wastes from scientific, industrial, and medical applications, are discussed. The radioisotopes are fixed in relatively large amounts on solid particles in suspension and on mud. The program of studies on the waters of the Seine basin and various French rivers has been supplemented by examination of mud collected over a certain period by means of special submerged tanks. This examination yielded representative data on the radioisotopes transported by the water during the sampling period (normally one month). The mud collected exhibited an activity considerably higher than that of the water, and is suitable for direct gamma spectrometry and various other analyses. The examinations carried out include: direct gamma spectrometry; drying and crushing; alpha, beta, and gamma measurements on the dried mud; and separation of the sand, clay, and organic matter fractions from the fresh mud. Investigations were also made of the fixation capacity, of the mud and its various components, of radioisotopes of Cs, Sr, Ce, Ru, P, and I and their significance in fallout or in scientific uses. The purifying role of mud is confirmed by the results of measurement of fixation capacities. Depending on their nature and chemical form radioisotopes may be only slightly fixed (iodine), or may be almost totally fixed (cerium). A large part of the activity transported by surface waters is thus eliminated by deposition of mud or by filtration plants. (auth)

**43545** DISTRIBUTION OF $^{65}$Zn IN PLANKTON FROM OFFSHORE WATERS OF WASHINGTON AND OREGON, 1961-1963. Lewis, Gary B.; Seymour, Allyn H. (Univ. of Washington, Seattle). 12p. (CONF-650654-2). ORAU. Gmelin, AED-CONF-65-167-5.

From Ocean Science and Engineering Conference, Washington, D. C.

The distribution of $^{65}$Zn values for unsorted plankton caught in a No. 6 mesh net within 135 miles of the mouth of the Columbia River conforms to the general pattern of the horizontal distribution of Columbia River water. The principal sources of $^{65}$Zn in this area are the Hanford nuclear reactors, 350 miles upstream from the river mouth. Analyses of 238 samples collected between January 1961 and December 1963 indicate significant seasonal, but not annual, changes and a close relationship between $^{65}$Zn in river water and plankton. Maximum $^{65}$Zn values for all seasons occurred near the Washington coast in the winter, in the spring the values increased off the river mouth and southward, values for the southern offshore area reached a maximum in the summer, the autumn season was characterized by minimum values in all areas. The data were described by the geometric mean since the array of the $^{65}$Zn values approximated a log-normal distribution. Values ranged from zero to 1,300 picocuries of $^{65}$Zn per gram of dry plankton. (auth)

**43546** THE ISOTOPES $^{22}$Na AND $^{24}$Na IN THE ATMOSPHERE. Roedel, W. Heidelberg, Univ., 1964. 75p. $2.00 Gmelin, AED-Diss. 64-2008.

Thesis.

Sodium-24 produced by cosmic rays was detected in rain water samples. Average concentration in rain is 320 atoms/liter corresponding to a few percent of the tropospheric production. Results of determinations in rain 1962-64 are given. A large fraction of the activity is due to nuclear explosions. (Gmelin Inst.)

**43547** ESTESTVENNYI NEITRONNYI FON ATMOSFERY I ZEMNOI KORY. (Natural Neutron Background of the Atmosphere and Earth Crust). Gorshkov, G. V.; Zyabkin, V. A.; Lyatkovskaya, N. M.; Tsvetkov, O. S. Moscow, Atomizdat, 1966. 410p.

A quantitative evaluation is given of the natural neutron level in the atmosphere, water, and rocks of the earth's crust. The height, latitude, and longitude dependences of the neutron intensity are reported. The formation of neutrons in the atmosphere under the effect of primary cosmic radiation (protons, $\alpha$ particles, heavy nuclei) and secondary radiation (fast nucleons, $\pi$ mesons, $\mu$ mesons, photons, and electrons) was examined. The intensity of neutrons coming from the sun is evaluated. The regular and irregular variations of the natural neutron background are described. The rate of neutron formation in rocks of the earth crust as a consequence of the spontaneous fission of heavy nuclei by ($\alpha$,n) reactions, the formation of neutrons at different depths under the effects of cosmic radiation, and the photoneutron reactions resulting from the fission of heavy nuclei are evaluated. The neutron spectrum in the atmosphere and in rocks of the earth's crust is described. (tr-auth)

## Site Survey and Selection

**43548** RADIOMETRIC MEASUREMENTS IN SELECTED POINTS OF THE ISLAND OF UNIVERSITARIA, NEAR GUANABARA. Meyer, Edgard; Ballariny, Marisa (Comissao Nacional de Energia Nuclear, Rio de Janeiro). An. Acad. Brasil. Cienc., 37: 209-19(1965). (In Spanish).

Radiometric measurements were made in 1963 and 1964 of the background, soil, vegetation, and air before the construction of the Argonaut reactor and of the startup of the reactor. The results obtained for the air activities are tabulated. (J.S.R.)

## Techniques and Equipment

*Refer also to abstracts 43094 and 43163.*

**43549** (NP-16200) THE APPLICATION OF RADIOACTIVE TRACERS IN THE STUDY OF SAND MOVEMENTS IN RIVERS. Report No. 4 (Final). Vukmirovic, Vojislav (Institut za Vodoprivredu "Jarsolav Cerni," Belgrade (Yugoslavia)). Dec. 1965. IAEA Contract 207/R1/RB. 93p. Dep. mn.

The development of a kinetic theory of bed material discharge to study sand movement in rivers is presented. The theory was applied to sand movement in the Velika Morava River, using $^{51}$Cr as a tracer. In the study, 95% of the sand did not move more than 6m downstream and the tracer penetrated to 14 cm in depth. (F.S.)

**43550** (NYO-844-67) NUCLEAR CHEMISTRY AND GEOCHEMISTRY RESEARCH. Progress Report, 1965-1966. Kohman, Truman P. (Carnegie Inst. of Tech., Pittsburgh. Dept. of Chemistry). June 30, 1966. Contract AT(30-1)-844. 67p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Research activities in nuclear chemistry, nuclear geology, nuclear reaction studies and instrumentation are summarized. Laboratories, instruments, and irradiation facilities used are described. Lists of publications published and in preparation are included. (F.S.)

**43551** (VUF-3015) SEISMIC VELOCITY DETERMINATION AND DISTANCE MEASUREMENTS IN A SALT DOME. PROJECT DRIBBLE, SALMON EVENT. McLamore, V. R. (Teledyne Industries, Inc., Pasadena, Calif. Earth Science Div.). Apr. 1965. 72p. Dep. mn. CFSTI $1.50 cy, $0.75 mn.

The downhole hardware and recording system designed to record high frequency energy including both compression and shear wave arrivals with unprecedented resolution is described. The compressional (4516 m/sec) and shear wave (2520 m/sec) velocities determined between the air filled 17½-in. dia uncased hole (Station 1-A) and mud filled 12¼-in. dia uncased hole separated by approximately 22.5 m in the depth interval 701 m to 762 m are internally consistent and accurate to ±1%. This conclusion is believed valid in spite of trouble with the depth measuring equipment and resultant requirement for elaborate data reduction in which shot depths were adjusted based on the constraints that the compressional velocity was constant in the region investigated and that the holes were near vertical. It was demonstrated that distance measurements between the drill holes can be made to an accuracy of ±2% or one foot, whichever is greater for ranges out to at least 140 m. However, if these data are to be used to emplace downhole hardware with significant vertical separations after the measurement, a downhole reference point is recommended to overcome the problems inherent in measuring from the surface with accuracy of a few parts in 10,000. The up-hole surveys in instrument holes E-4 (318.6 m, n 57° 41′ E of GZ), E-11 (615.2 m, S 75° 38′ W of GZ) and WP-4 (340.4 m, S 19° 15′ W of GZ) gave compressional wave velocities of 4570 m/sec, 4570 m/sec, and 4544 m/sec, respectively. The minimum accuracy of the uphole surveys is ±5% with probable accuracy being in the order of ±3%. The average of the four velocity determinations made is 4550 m/sec. The spatial variation in these observed velocities is 54 m/sec, or 1.2%. (auth)

**43552** THERMOLUMINESCENCE OF CALCITE FROM HIGH GAMMA RADIATION DOSES. Vaz, J. E.; Zeller, E. J. (Univ. of Kansas, Lawrence). Contract AT(11-1)-1057. Amer. Mineral., 51: 1156-66(July 1966).

Three calcium carbonate samples were subjected to large total doses of both gamma radiation and ultraviolet. Each sample was divided into three portions which were heated prior to irradiation. The individual aliquots were heated at different temperatures prior to the radiation treatment in order to observe the effects of heating. The peak intensity vs. dose curves of the thermoluminescence induced in the samples by gamma rays rise to a maximum at a total dose of about $3 \times 10^6$ R. Increasing the total gamma dose may result in a decrease in light output. Further evidence of trap depopulation is furnished by the sharp rise in peak temperature which takes place at total gamma doses above $3 \times 10^6$ R. A defect induced by the gamma radiation in the calcite crystal structure may be responsible for this effect. Glow-curves are also obtainable from samples which have been illuminated with ultraviolet light. The peak intensities are markedly lower than they are in the gamma irradiated samples. The results obtained from both the gamma and the ultraviolet irradiations suggest that retrapping may be a very important process in the thermoluminescence of calcite. (auth)

**43553** METHOD FOR DETERMINATION OF OIL–WATER INTERFACE BASED ON DELAYED NEUTRON DETECTION. Dorosh, M. M.; Kostyu, Ya. E.; Shkoda-Ulyanov, V. A.; Parlag, A. M.; Berzin, A. K. At. Energ. (USSR), 21: 35-8(July 1966). (In Russian).

A method for the determination of the boundary between water- and oil-saturated layers of rocks, based on the $^{18}$O content of the water and oil, was suggested. Experiments were made using $^{17}$N as a source of delayed neutrons. (tr-auth)

**43554** WELL-LOGGING IN BAUXITE-PROSPECTING [NEUTRON ACTIVATION LOGGING]. Sebesty'en, K.; Andrassy, L.; Morvai, L. Geofiz. Kozlem., 13: 369-78 (1964). (In Hungarian).

Numerous analyses, have demonstrated that specific resisitivity and natural radioactivity are suitable to trace sedimentary complexes composed of clay, marl and limestone. The variation of specific resistivity permits conclusions as to the change of the carbonate-content of marls. The logs are suitable for correlation, too, since they permit some key-horizons to be traced. The bauxite is indicated by the apparent resistivity and natural radiation. It can be distinguished by gamma-gamma measurements. Continuous neutron activation logging is the best method. The alumina-content may also be determined by this method. (auth)

**43555** USE OF RADIOACTIVE ISOTOPES IN HYDROGEOLOGICAL RESEARCH. Botezatu, Nicu Paul. Hidrotechnica (Bucharest), 10: 435-40(Aug. 1965). (In Rumanian).

Published technical articles dealing with theoretical or practical aspects of the use of radioactive isotopes with applications to hydrogeology were surveyed. The topics covered include general methods of radiation measurement, apparatus, and methods of working with radioactive isotopes that are specific to hydrogeological research. Included are 15 figures and 7 references, six of which are Rumanian and one Hungarian. (JPRS)

**43556** LEAD-ALPHA AGES OF SOME GRANITIC ROCKS FROM NORTH KYUSHU AND CENTRAL JAPAN. Karakida, Yoshifumi; Tomita, Toru (Kyushu Univ., Japan). Mem. Fac. Sci., Kyushu Univ., Ser. D, 16: 249-63 (Nov. 1965).

Lead-alpha age determinations were made on accessory zircons and monazites of granitic rocks from the Fukuoka area, North Kyushu, and the eastern Aichi district and the Takato area, Central Japan. Six results for granitic rocks from the Fukuoka area range from 80 to 115 million yr with an average of 97 million yr. Of these results zircon and monazite from a single granite have the same age of 90 million yr. This agreement between different minerals from the same rock indicates the reliability of the lead-alpha method. Four zircon ages and two monazite ages from the eastern Aichi district range from 70 to 105 million yr with an average of 90 million yr and nine zircon ages from the Takato area from 80 to 165 million yr with an average of 106 million yr. The Takato quartz diorite with an age of 165 million yr is of interest because it is older than other granitic rocks in the same area. Results of age determinations are, with a few exceptions, consistent with geological evidence and other isotopic ages. The granitic rocks from North Kyushu and the Ryoke belt in Central Japan are believed to be of Cretaceous age. (auth)

**43557** ISOTOPE GEOCHEMISTRY AND THE PLEISTOCENE CLIMATIC RECORD. Broecker, Wallace S. (Lamont Geological Observatory, Palisades, N. Y.). pp 737-53 of The Quaternary of the United States. Wright, H. E. Jr.; Frey, David G. (eds.). Princeton, N. J.; Princeton University Press, 1965.

The current status of isotope techniques employed for the determination of Pleistocene chronology and climate is summarized. Results derived from the application of these methods are evaluated. The conclusion is drawn that a generally reliable climatic record for the past 150,000 years has been obtained and that this record bears a remarkable resemblance to that predicted by Milankovitch-type isolation curves. (auth)

**43558** USE OF NEUTRON SCATTERING METHOD FOR MEASURING SOIL WATER CONTENT. Dimaksyan, A. M.; Dobychin, V. P. Tr., Gos. Gidrol. Inst., 130: 132-47 (1965). (In Russian).

The theory of the slowing down and scattering of neutrons in soils for the measurement of moisture was examined. Using neutron age and diffusion, the approximate dependence of neutron slowing down in soil on moisture content can be obtained. The formulas derived include all parameters necessary and sufficient for the construction of a neutron hygrometer. (tr-auth)

**43559** USE OF GROUND RADIOACTIVITY METHOD FOR MEASURING SNOW WATER RESERVE. Zotimov, N. V. Tr., Gos. Gidrol. Inst., 130: 148-62(1965). (In Russian).

The use of the natural radioactivity of soils for the measurement of water in snow and some other hydrometeorological elements was examined. The results of the measurement of the snow reserve and the effects of soil cultivation on the precision of these measurements were discussed. (tr-auth)

**43560** RADIOCARBON. Volume 8. Deevey, Edward S.; Flint, Richard Foster; Rouse, Irving (eds.). New Haven, Yale Univ., 1966. 552p. $10.00.

Data obtained from radiocarbon methods of age estimation are summarized in 34 papers. (F.S.)

**43561** SEDIMENT GAGE (Engineering Materials). (New York Operations Office (AEC), N. Y.). (CAPE–1432).

12 drawings.

To determine the amount of sediment carried by natural or man made waterways, a self-powered, continuous monitor using a radioisotope was developed. The gage has the capability of continuously measuring sediment concentration over the range 1000 to 50,000 ppM. The monitoring system consists of a shore unit connected to an underwater unit. The gage observes the ratio of x-ray transmission through ambient water containing suspended sediment and a reference liquid such as distilled water. (F.S.)

## Thorium and Uranium Minerals

**43562** PROBLEM OF MOVING OF HYDROTHERMAL SOLUTIONS. **Baranov, E. N.; Grigoryan, S. V.** At. Energ. (USSR), 20: 498-501(June 1966). (In Russian).

Characteristics of mineral distributions in endogenic corona surrounding ore bodies of hydrothermal uranium deposits indicate that the ore bodies and mineralization were not deposited by a continuous flow of circulating mineral-bearing solutions but by separate small portions of migrating hydrothermal solutions. The studies showed that pitchblende sulfide type deposits were formed at relatively shallow depths (500 to 700 m) at 150 to 200°C. (R.V.J.)

**43563** URANIUM CONTENT OF SOME INTERNATIONAL STANDARDS. **Hamilton, E. I.** (Radiological Protection Service, Sutton, Eng.). Earth Planet. Sci. Lett., 1: 317-18(Sept. 1966).

The U contents of six USGS standard rocks, three NBS samples, and two IAEA biological standards were determined by the delayed neutron method. Interference from delayed neutrons from Th was taken into account in the USGS samples by estimating the Th content by the thoronol method after preliminary chemical extraction of Th. (F.S.)

**43564** URANIUM CONTENT IN FLUORITES. **Baranov, E. N.** (Moscow Geological Inst. of Rare Earth). Geokhimiya, No. 8, 1006-9(Aug. 1966). (In Russian).

Analysis of 160 specimens collected from fluorite pegmatite and hydrothermal deposits showed the content of uranium to be from $1 \times 10^{-5}$ to $1 \times 10^{-4}$%. In rare cases it exceeded $1 \times 10^{-4}$%. Violet fluorites contained higher concentrations of uranium. The content of uranium in the violet and dark violet fluorites was over $3 \times 5^{-5}$%, while in the light violet light-green, green, and colorless it was lower than $3 \times 10^{-5}$%. (R.V.J.)

**43565** COMPARING STUDIES OF THE U CONTENTS OF ZIRCONS INCLUDING THEIR MORPHOLOGY. **Sansoni, G.** Jena, Ger., Univ., 1964. 140p. $2.00 Gmelin, AED-Diss. 64-1088.

Thesis.

Results of uranium determinations of 150 zircon samples are given. The influence of various parameters as impurities of surfaces, colorations, solubility of uranium, and behavior after crystallization are discussed. Construction of a reflection fluorimeter is described. (Gmelin Inst.)

# HEALTH AND SAFETY

**See also BIOLOGY AND MEDICINE — Radiation Hazards and Protection**
**GEOLOGY, METEOROLOGY, AND MINERALOGY — Natural Radioactivity and Fallout**

*Refer also to abstracts 43083, 43166, 43666, 43671, 43688, 43747, and 45219.*

**43566** (AD–625251) A SURVEY OF THE WEAPONS AND HAZARDS WHICH MAY FACE THE PEOPLE OF THE UNITED STATES IN WARTIME. Brode, Harold L. (RAND Corp., Santa Monica, Calif.). June 1965. 25p. (P–3170(RAND)). CFSTI $1.00 cy, $0.50 mn.

Radiological weapons discussed include the neutron bomb, penetrating weapons that create blast damage, and nuclear explosives. The hazards of nuclear radiation, blast, thermal radiation, shock waves, crater formation, and fallout from nuclear explosions are reviewed and the effects of the height of burst on the effects of nuclear explosions are discussed. It is pointed out that countermeasures are feasible against the rather indirect threats of poisonous gases, germ warfare, thermal radiation, water waves, and ground shock effects from distant explosions but it is most difficult and expensive to provide protection against a direct attack by nuclear weapons. (C.H.)

**43567** (AD–635820) RADIOLOGICAL RECOVERY REQUIREMENTS, STRUCTURES, AND OPERATIONS RESEARCH. INTRODUCTION AND SUMMARY. Final Report. Ryan, Joseph T. (Research Triangle Inst., Durham, N. C.). June 6, 1966. Contract N228(62479)–68153. 20p. (USNRDL-TRC–16(Summary)). CFSTI $1.00 cy, $0.50 mn.

The primary objective of this study was to determine cost and effectiveness information relating to the application of decontamination and the extent of its utility when applied to the recovery of extensive city areas in a post-attack environment. The general approach toward meeting the objectives of the study, including a brief description of each of the models developed under the contract, is outlined. The command and control aspects of municipal decontamination are summarized, and the results of a systems analysis of decontamination are briefly stated. The results of the extensive real-cities analyses conducted under the subtask are summarized. Both general and specific conclusions and recommendations are stated. The results of the real-cities analyses showed that roof decontamination is an important part of most combined strategies of decontamination. These results also showed that the recovery of substantial city areas and multi-building complexes could be accelerated appreciably by practicable decontamination procedures. (auth)

**43568** (AD–636787) A COMPARISON OF THEORY AND EXPERIMENT FOR SHIELDING BY A STRUCTURE AGAINST FALLOUT RADIATION. Report No. 1. Preiss, K.; Chilton, A. B. (Illinois Univ., Urbana). June 1966. Contract OCD-OS-63-66. 55p. CFSTI $3.00 cy, $0.50 mn.

A comparison was made between experiment and theory for the calculation of the shielding properties of a structure against fallout radiation. Experimental results for exposure penetrating a roof slab, and for reduction factor, were found to agree with moments theory calculations, often to better than 10% when the geometry factor $L_a(\omega,X)$ was used. A comparison between experiment and theory may be inaccurate due to anisotropy of the experimental source to lack of source reflection in roof experiments and due to error in estimating the thickness of the roof. The magnitudes of the errors due to these effects were investigated, and found to be small, but not necessarily negligible. Detailed results of penetration in iron and concrete, due to plane isotropic sources of various energies, are given and a review of ground contribution to fallout radiation penetration through simple structures is appended. (auth)

**43569** (AED-C–13-04) BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. Section 13: Decontamination. Philipp, H. (comp.) (Zentralstelle fuer Atomkernenrgie-Dokumenation, Gmelin-Institut fuer Anorganische Chemie und Grenzbebiete, Frankfurt am Main (West Germany)). June 1966. 144p. Dep. mn.

Abstracts are presented on 212 reports from the atomic energy international literature on decontamination methods and equipment. Author and report number indexes are included. (C.H.)

**43570** (AEET–244) DEVELOPMENT OF U-FOAM AIR FILTERS. Khan, A. A.; Amalraj, R. V.; Thomas, K. T. (Atomic Energy Establishment, Trombay (India). Health Physics Div.). 1966. 18p. Dep. mn.

These filters are low-pressure-drop air filters of fibrous structure which may be used as pre-filters. Their physical and chemical properties are described in detail. The construction of prototype units is discussed. Pressure-drop characteristics, filtering efficiencies, and costs are given. (D.L.C.)

**43571** (AHSB(RP)–R–70) PHYSIOLOGICALLY SAFE WORKING CONDITIONS FOR MEN WEARING PRESSURISED SUITS. Rowlands, R. P. (Atomic Health and Safety Branch, United Kingdom Atomic Energy Authority, Harwell (England)). June 1966. 82p. Dep. BIS.

Pressurized suits, worn to protect individuals from a toxic environment, may result in physiological stress due to rebreathing of exhaled carbon dioxide and heat due to body heat. Results are reported from a series of investigations of the basic principles of the thermal environment. Three formulae were derived, two of which provide means for predicting the level of thermal stress in given work situations, and one that predicts the rate of sweating. Other physiological responses, such as body temperature and heart rate, are obtained from consideration of the zones into which the values of the index of thermal stress are divided, namely comfortable, tolerable, barely tolerable, and intolerable. Control charts were prepared for a variety of conditions whereby the rate of supply of breathing air can be controlled. Use of the control charts permit flexibility in the management of operations requiring workers wearing pressurized suits. (C.H.)

**43572** (BNWL-SA–816) RADIATION DOSIMETRY FOR RADIATION PROTECTION. Roesch, W. C. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug. 9, 1966. Contract AT(45-1)–1830. 18p. (CONF-660815–1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Conference on Principles of Radiation Protection, Oak Ridge, Tenn.

Development of concepts used in describing radiation fields and their interactions with matter are described. Modification of the basic concepts of radiation dosimetry to fit the primary goals of radiation protection are discussed. It is suggested that some physical quantity other than absorbed dose might give a closer correlation with biological effects than does dose. Hence, other methods of correlating dose with biological effects were evaluated, including: the use of momentum to supplement or replace energy in correlating biological effects; relating the probabilities of biological effects to the mean LET; and measurement of individual absorbed energies with a proportional counter made of tissue-equivalent materials and applying the theory of irradiated media of uniform composition but varying density to establish that the deposition of energy in the counter is the same as that in a solid biological entity of the same shape but smaller in size of the ratio of the gas density in the counter to the density of the solid. (H.G.D.)

**43573** (CONF-765-13) DIETARY INTAKE OF RADIONUCLIDES: A. EFFECT OF CONSUMPTION PATTERNS. B. EVALUATION BY USE OF INTEGRATING SAMPLES. Thompson, J. C. Jr.; Lengemann, F. W. (New York State Veterinary Coll., Ithaca, N. Y. Dept. of Physical Biology). [1964]. Contract AT(30-1)-2430. 32p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From 2nd Conference on Radioactive Fallout from Nuclear Weapons Tests, Germantown, Md., Nov. 1964.

Variations in radionuclide ($^{131}$I, $^{137}$Cs, $^{90}$Sr) intake resulting from changes or differences in food consumption can be significant, but the actual range of intake levels may be unknown because of the lack of appropriate food consumption data. In an attempt to compensate for the inadequacy of radionuclide estimates derived from food consumption data, several approaches were proposed including development of improved food consumption estimates for many segments of the population; determination and use of appropriate $OR_{urine/diet}$ values for the various population groups (food consumption information would not be necessary to obtain this information); and use of the urinary $^{137}$Cs/$^{90}$Sr ratio as a $^{90}$Sr indicator when environmental levels of fallout are relatively stable. None of the techniques will completely solve the problem, but each may aid in defining those groups of the population requiring further study. (16 references.) (auth)

**43574** (CONF-660538-1) BIOENVIRONMENTAL RADIATION RESEARCH PROJECT. Barth, D. S. (Public Health Service, Las Vegas, Nev. Southwestern Radiological Health Lab.). May 23, 1966. 20p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From American Public Health Assn. Meeting, Las Vegas, Nev.

A description is given of a research program which was created with the general mission of developing human radioiodine exposure-dose relations for a variety of field sources and a variety of realistic modifying parameters. Organization, facilities, equipment, and general approach to the many problems to be solved are presented. Brief descriptions of types of field experiments in which the radioactivity is derived from actual field nuclear debris or the controlled release of radionuclides over growing forage crops at an experimental farm are given. The radioisotopes studied include $^{131}$I, $^{132}$I, $^{133}$I, $^{134}$I, and $^{135}$I, which are produced as fission products in potentially hazardous amounts. (C.H.)

**43575** (CONF-660621-1) ANTICONTAMINATION CLOTHING: NO BUTTONS, ZIPPERS, OR TAPING REQUIRED. FitzGibbon, J. T. (Knolls Atomic Power Lab., Schenectady, N. Y.). June 1966. Contract W-31-109-eng-52. 9p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Health Physics Society, 11th Annual Meeting, Houston, Tex.

Anticontamination protective clothing was developed for use by personnel performing maintenance on nuclear reactor plants. The clothing is designed to protect the worker's head, neck, and ears, body, and extremities from radioactive contamination; eliminate clothing closure devices such as buttons, snaps, and zippers which could become separated from the garment and fall irretrievably into open reactor plant systems and components; and eliminate the profuse use of pressure sensitive tapes customarily applied to the garment to seal flyfronts, pockets, and other openings, and secure gloves and shoe covers to the garment. (auth)

**43576** (CONF-660621-7) RADIOIODINE STUDIES FOLLOWING THE TRANSIENT NUCLEAR TEST (TNT) OF A KIWI REACTOR. Barth, D. S.; Black, S. C. (Public Health Service, Las Vegas, Nev. Southwestern Radiological Health Lab.). [1965]. 14p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Health Physics Society, 11th Annual Meeting, Houston, Tex.

In conjunction with the Transient Nuclear Test of a Kiwi reactor, hay contamination and controlled dairy cow ingestion studies for radioiodines were conducted. The study was designed to simulate the maximum possible radioiodine uptake by dairy cows from typical winter dairy farming practices where radioiodines enter the cows via ingested contaminated hay. The kinetics of the secretion of radioiodines in milk under the conditions of this experiment were determined. Peak values of 830 pCi/liter for $^{133}$I and 150 pCi/liter for $^{131}$I were observed in milk of individual cows. For $^{131}$I the effective decay half-life in the milk of one group of cows during feeding of contaminated hay was found to be 5.5 days, whereas for another group it was 2.8 days. (auth)

**43577** (DPST-66-30-2) EFFECT OF THE SAVANNAH RIVER PLANT ON ENVIRONMENTAL RADIOACTIVITY. Semiannual Report, January Through June 1966. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). Aug. 1966. Contract AT(07-2)-1. 17p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The results of the environmental monitoring program for the period January 1 through June 30, 1966, for the atmosphere, vegetation and food, and water are reported. The quantity of radioactive waste released by the Savannah River Plant to its environs was, for the most part, too small to be distinguished from natural background radiation or was obscured by worldwide fallout from nuclear weapons testing. Fallout from the Chinese nuclear test on May 9, 1966, was detected at SRP. Beta activity in air, which showed no relation with plant operations, was about one-half of that for the same period of 1965. Radioactive materials in fish flesh continued to be far below levels considered significant from a health standpoint. The average concentration of radionuclides in river water did not exceed 3.7% of the Maximum Permissible Concentrations. (auth)

**43578** (HW-59541) NUCLEAR SAFETY IN PLUTONIUM METALLURGY. Ketzlach, N. (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Mar. 6, 1959. Contract AT(45-1)-1350. 8p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Standards for safe operation in manufacture, storage, and handling of Pu metal, Pu oxides, and Pu–Al alloys are discussed. (J.R.D.)

**43579** (INR-725/XXII/C) WPLYW SRODKOW POWIERZCHNIOWO CZYNNYCH NA EFEKT DEKONTOMINACJI. (The Influence of Surface-Active Agents on the Effect of Decontamination). Siemaszko, Aleksander (Institute of Nuclear Research, Warsaw (Poland)). May 1966. 67p. CFSTI $3.00.

The effects of surface-active agents on the decontamination of surfaces of different plant materials were examined. It was established that this effect is principally the result of inhibition of ions by detergent molecules (sorption on micellae, ion exchange, and complex formation). This stopping, along with other interactions, decreases considerably the sorption and is the cause of the detachment of the adsorbed ions on the decontaminated surface. (tr-auth)

**43580** (NAA-SR-Memo-11901) FAST NEUTRON WEIGHTING FACTORS FOR MANRATED SNAP REACTOR APPLICATIONS. Spangler, G. W. (Atomics International, Canoga Park, Calif.). Apr. 20, 1966. Contract AT(11-1)-Gen-8. 18p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A review of the RBE problem is presented, and its relation to fast neutron weighting factors for SNAP manrated reactor systems is discussed. Reasonably justified fast neutron weighting factors can be specified for particular SNAP reactor applications; however, there is insufficient experimental justification for a firm specification of general weighting factors. (auth)

**43581** (NP-16245) ANNUAL REPORT FOR THE YEAR 1965. (National Radiation Lab., Christchurch (New Zealand)). 41p. (NRL-AR-16). Dep. mn.

The National Radiation Laboratory of New Zealand provides assistance in the field of radiological physics to medical users of x radiation, Ra, and sealed and unsealed radioisotope sources, and provides radiation protection services for the population. Activities during 1965 included the routine monitoring of radiology medical personnel and facilities, measurements of the radiation dose received by patients during diagnostic radiography, and measurements of the radiation dose in dental surgeries. Studies on environmental radioactivity due to fallout or to naturally occurring $^{210}$Pb, $^{226}$Ra, or $^{222}$Rn, or to $^{210}$Po in tobacco are reported. Data are included on the content of $^{90}$Sr in milk, rain water, and soil, and the content of $^{137}$Cs in milk and wheat flour sampled during 1965. (C.H.)

**43582** (ORNL–3985) CHARACTERIZATION OF VOLATILE FORMS OF IODINE AT HIGH RELATIVE HUMIDITY BY COMPOSITE DIFFUSION TUBES. Adams, R. E.; Bennett, R. L.; Browning, W. E. Jr. (Oak Ridge National Lab., Tenn.). Aug. 1966. Contract W-7405-eng-26. 25p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Radioiodine is one of the principal fission products of interest in reactor safety evaluations. It may exist as vapors of the element or as a compound as well as either of these forms adsorbed on dispersed particulate material. Information about such species and analytical methods for detecting them are required to interpret nuclear safety experiments and for designing adequate gas-cleaning systems. One device which has been used for iodine characterization is the composite diffusion tube which is composed of a sequence of silver, rubber, and charcoal lined sections. This device yields diffusion coefficients for the depositing species as well as information on the completeness of deposition on each section. High humidity interferes with the performance of this device by lowering the efficiency of retention of organic iodides by the charcoal section. Methods for minimizing the moisture effects which have been investigated include placement of various desiccants after the silver section and substitution of the normal charcoal lining with less water-sensitive material. Of several desiccants tested, Drierite (anhydrous calcium sulfate) was found to be superior due to its low retention of the volatile organic iodide (mainly $CH_3I$). A special iodine-impregnated charcoal (MSA No. 85851) yielded improved deposition profiles and retention. With these modifications the composite diffusion tube can be used for distinguishing elemental iodine and the more penetrating forms under high humidity. (auth)

**43583** (ORNL-P–2387) REQUIREMENTS FOR FIRE-RESISTANT HIGH-EFFICIENCY PARTICULATE AIR FILTERS. Burchsted, C. A. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 12p. (CONF-660904–9). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 9th Air Cleaning Conference, Boston, Mass.

The establishment of certain basic specification requirements is essential to the procurement of suitable high-efficiency particulate air filters with a minimum of difficulty and cost. Problems have been experienced in the manufacture and procurement of these filters because of inconsistent, ambiguous, and conflicting specification requirements as well as requirements that are not restrictive enough. Requirements for high-efficiency particulate air filters are presented that are intended to guide the specification writer toward standards that will produce uniformity in construction and testing practices to bring the cost of these units down to reasonable levels without sacrificing the necessary performance. (auth)

**43584** (ORNL-P–2411) IN-PLACE IODINE FILTER TESTING. Swanks, J. H. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 14p. (CONF-660904–11). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 9th Air Cleaning Conference, Boston, Mass.

A series of in-place iodine filter tests was performed on the charcoal iodine filters at the High Flux Isotope Reactor. Two sets of charcoal filters were tested, the first for elemental iodine retention; and the second for methyl iodide and elemental iodine retention. Test results are presented, and conclusions drawn from those results are discussed. (auth)

**43585** (ORNL-TM–1589) FOAM DECONTAMINATION OF AIR CONTAINING RADIOACTIVE IODINE AND PARTICULATES FOLLOWING A NUCLEAR INCIDENT. Jury, S. H. (Oak Ridge National Lab., Tenn.). Oct. 1966. Contract W-7405-eng-26. 21p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Foam suppression of radioactive iodine and particulates following a nuclear incident is briefly reviewed, emphasis being placed on methods of characterizing and categorizing the various contaminants. It is proposed that volatile contaminants can be sorbed on the particulates and the latter, via Einsteinian diffusion, can act as vehicle for transport of radioactive contaminants to the surface of the bubble. In the light of this kinetic mechanism an investigation was made via a mathematical analysis of diffusion in bubbles in static foam and in foam beds subjected to elution. It was shown that in the absence of chemical reagents to reduce the vapor pressure of radio-volatile components, the elution operation is a basic requirement to attain decontamination factors of $10^{-3}$ to $10^{-6}$ in the gas phase of the bubble. For mathematical convenience the decontamination factor is here defined as the ratio of final over initial concentration. Even if vapor pressure and back-diffusion of radio-volatile components is not a problem the bed must still be eluted to prevent redispersing the contaminants during the foam collapsing phase of the operation. A number of other factors are discussed (involving the cost of the operation, equipment and its maintenance, the problem of uniform eluant feed distribution, velocity criteria, and dynamic decontamination factor via which one can exercise some control over back diffusion). (auth)

**43586** (PNRO-DEV–136) ENVIRONMENTAL RADIOACTIVITY AT THE BETTIS ATOMIC POWER LABORATORY FOR THE SECOND SIX MONTHS OF 1965 AND FOR CALENDAR YEAR 1965. (Bettis Atomic Power Lab., West Mifflin, Pa.). Jan. 31, 1966. Contract AT(11-1)-Gen-14. 21p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Measurements of radioactivity in the liquid effluent and fallout, as well as measurement of background radiation at the boundaries of the Bettis Atomic Power Laboratory during the second six months of 1965, showed no significant contribution by the Laboratory operations to environmental radioactivity levels. (auth)

**43587** (RM–4968-TAB) PLAGUE IN THE UNITED STATES: AN ASSESSMENT OF ITS SIGNIFICANCE AS A PROBLEM FOLLOWING A THERMONUCLEAR WAR. Mitchell, H. H. (RAND Corp., Santa Monica, Calif.). June 1966. Contract AT(04-3)-414. 54p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

The modern pandemic of plague which started in China in 1855 brought this disease to the United States. Domestic rodents in several port cities having become infected, the disease spread to wild rodents, in which it has apparently become permanently endemic. Since 1900, over 500 human cases of plague have occurred in the United States. Although the total number of cases is small, and in recent years has declined almost to zero, the potential exists for a large-scale epidemic. Even a single case of bubonic plague can become pneumonic and start the human-to-human spread which may then involve large numbers of people. With the postattack environment in mind several suggestions for increased involvement of other government agencies have been recommended. The Civil Defense authorities should have accurate information about endemic plague foci, medical and public health personnel at all levels should be alerted and trained to handle plague-suspected incidents, and studies should be conducted on the best methods for combating plague should it occur in the postattack environment. Our knowledge of the disease and its epidemiology, along with modern methods of control and treatment, makes it highly unlikely that an epidemic will take place even in the disordered environment of a postattack situation. However, this possibility cannot be ruled out entirely if one wishes to assume a sufficiently serious breakdown of organized society as we know it today. (auth)

**43588** (RM–5090-TAB) SURVEY OF THE INFECTIOUS DISEASE PROBLEM AS IT RELATES TO THE POSTATTACK ENVIRONMENT. Mitchell, H. H. (Rand Corp., Santa Monica, Calif.). Aug. 1966. Contract AT(04-3)-414. 89p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Plague presents its own peculiar problem because there are endemic foci in the wild rodent population of the United States, and a plague problem is possible in the postattack environment. An evaluation of the current tuberculosis situation together with an understanding of its historical records suggests that this disease may well be one of the great problems in the postattack environment. The respiratory diseases raise questions of a change in intensity of effect because of postattack environmental hardships. A strong recommendation for further study is made here. The problem of the carrier state and the widespread availability of "seed" cases for such diseases as diphtheria and typhoid point up the ease with which these diseases may become serious if the postattack environment does not provide adequate public health safeguards. The investigation of the epidemiology of various diseases from the viewpoint of projection into the postattack situation should reveal where different emphasis ought to be placed on the allocation of pertinent resources. (H.L.W.)

**43589** (STI-PUB-118) ENVIRONMENTAL MONITORING IN EMERGENCY SITUATIONS. A Manual Based on the Work of a Panel of Experts. Safety Series No. 18. (International Atomic Energy Agency, Vienna (Austria)). 1966. 128p. IAEA: $3.00; S63-,; 18/-stg; F Fr 12-; DM 10,50.

This manual gives technical guidance on appropriate emergency monitoring procedures for the assessment of radioactive contamination after accidents resulting in the uncontrolled release of radioactive substances to the environment. Topics discussed include the objectives of emergency environmental monitoring programs; the types of facilities where radiation accidents may occur and their inventories of radioactive materials; the types of accidents that may occur and their associated release of radioactive materials; the dispersal of released material in the environment and possible modes of human exposure; organization for emergency monitoring; and monitoring equipment and procedures. (C.H.)

**43590** (UCRL–14707) ESTIMATION OF DOSAGE TO THYROIDS OF CHILDREN IN THE U. S. FROM NUCLEAR TESTS CONDUCTED IN NEVADA DURING 1952 THROUGH 1955. Tamplin, Arthur R.; Fisher, H. Leonard (Lawrence Radiation Lab., Univ. of California, Livermore). May 10, 1966. Contract W-7405-eng-48. 53p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Estimates of the thyroid dosage accumulated by children up to 5 years of age in the United States as a result of nuclear weapons tests in Nevada during 1952 through 1955 are reported. The estimates are based upon the assumption that the children were consuming 1 liter of milk per day from cows on pasture. It is not known to what extent this assumption is valid. The data, the analytical approach, and the assumptions inherent to the analysis are presented, together with the estimates. (auth)

**43591** (UR–49-687, pp 132-47) RADIOLOGICAL AND HEALTH PHYSICS, AND INSTRUMENTATION. (Rochester Univ., N. Y. Atomic Energy Project).

Abstracts are presented on 7 publications during 1965 in the fields of health physics and the development of radiation detection instruments. Bibliographic information is included. (C.H.)

**43592** (USNRDL-TR–1042) RADIOACTIVITY RELEASE FROM RADIONUCLIDE POWER SOURCES. II. RELEASE OF STRONTIUM TITANATE TO THE OCEAN ENVIRONMENT. Goya, H. A.; Lai, M. G.; Kubose, D. A. (Naval Radiological Defense Lab., San Francisco, Calif.). Apr. 24, 1966. Contract AT(49-5)-7084(2). 11p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The dissolution in an ocean environment of two $^{85}$Sr titanate pellets was studied to determine the rate of release of radioactivity. The experiment was intended to indicate the dissolution behavior of $^{90}$Sr radioisotopic fuel in the ocean, as limited by the much lower activity of the specimens and the lack of laboratory control which precluded the coverage of all parameters and highly sensitive dissolution detection. The physical dimensions of the specimens were measured. Preliminary laboratory determination was made of initial release rates for comparison with previously obtained data from similar specimens. Then the specimens were immersed at 30 feet, a mile from shore, where the ambient temperature ranged from 12 to 17°C (from January to July), which was within 1°C of the surface temperature. They were exposed to chemical and biological interactions in five increasingly longer periods, for a total of 1065 days; after each period they were removed for cleaning of biological growth and for radioactivity measurement. Activity release rate was determined through loss of activity from the specimens, measured on a gamma ionization chamber and a gamma scintillation counter, as normalized to the mean activity of a control decay standard measured concurrently. Although this technique avoided errors that might arise through calculation based on half-life, counting geometry, or counter stability with time, some error remained due to counting statistics of the order of 1% of the total specimen activity. After the later exposure periods, the specimens were well covered by biological growth, of different types in different seasons of the year. Although the growths mostly did not visibly damage the specimen surfaces, one specimen had a skeletal growth which penetrated its surface. The measurements of the physical dimensions of the specimens after exposure were erratic and inconclusive, the biological growth being impossible to remove completely without damage to the specimens. For the entire exposure of one specimen and the first half of exposure of the other, the total release of strontium titanate was about 40 mg, or a release rate of 4 $\mu$g/cm$^2$/day. This was based on a release of radiostrontium that was within the error range of the measurement system, about ±1%. For the last half of exposure of the other specimen, the release rate accelerated to about 14 ± 4 $\mu$g/cm$^2$/day. This rate is about an order of magnitude greater than those previously reported. Since the experimental conditions of the ocean testing were not controlled, the acceleration of release can be attributed only to the action of biological growth on the sample. (auth)

**43593** (AEC-tr–6642) VENTILATION IN WORK WITH RADIOACTIVE SUBSTANCES. Krupchatnikov, V. M. Translation of Ventilyatsiya pri Rabotakh c Radioaktivnymi Veshchestvami, Atomizdat, Moscow, 1964. 174p. (IPST-Cat.–1699). Dep. CFSTI $5.00 cy, $1.00 mn.

Principles of the technological processes of ventilation in radioisotope laboratories are reviewed. Occupational hazards in radioisotope laboratories and the design and use of ventilation equipment are considered. The cooperation of medical and sanitary personnel in evaluating objectively the effectiveness of planned safety measures is stressed. (H.G.D.)

**43594** (AEC-tr–6763) MONITORING URANIUM MINE ATMOSPHERES FOR SHORT-LIVED DAUGHTER PRODUCTS OF RADON (REVIEW). Markov, K. P.; Ryabov, N. V.; Stas, K. N. Translated from publication No. 105 of the State Committee on the Use of Atomic Energy USSR, Moscow, 1965. 8p. Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.10 fs, $0.80 mf.

Methods for measuring the content of short-lived Rn daughter products in uranium mine atmosphere are reviewed. It is pointed out that methods have been developed for measuring the content of $^{218}$Po, $^{214}$Pb, and $^{214}$Bi in air filter samples that are practical for dosimetry. (C.H.)

**43595** A PLUTONIUM PARTICLE SIZE STUDY IN PRODUCTION AREAS AT ROCKY FLATS. Kirchner, R. A. (Dow Chemical Co., Golden, Colo.). Contract AT(29-1)-1106. Amer. Ind. Hyg. Ass. J., 27: 396-401 (July-Aug. 1966).

Particle size analyses of 16 air samples obtained during maintenance operations which caused high airborne concentrations of plutonium in chemistry and fabrication plants are reported. The air samples showed an average mass median diameter (MMD) of 0.884 micron and an average count median diameter (CMD) of 0.213 micron. The average geometric deviation ($\sigma_g$) was 2.02. Particle size spectra obtained during simulation of two personnel inhalation incidents showed MMD's of 4.1 ($\sigma_g = 2.36$) and 1.2 ($\sigma_g = 1.84$) microns. All analyses related the number of alpha tracks on Kodak Type A personnel neutron film to the size of $PuO_2$ or $PuF_4$ particles on membrane filter paper. (auth)

**43596** CONTAMINATION OF THE BIOSPHERE BY ARTIFICIAL RADIOELEMENTS. Kirchmann, R. (CEN, Mol, Belg.). Ann. Gembloux, 70: 215-23(1964). (In French). (BLG-337).

The fission products released by nuclear detonations constitute a potential hazard from the biological point of view. The various sources of contamination are mentioned and discussed. Examples, drawn from the literature, of the levels of contamination of beings living in water (marine and fresh water) are given. In the contamination of the terrestrial environment by the radioactive fallout, the role of the soil and the two mechanisms that influence the contamination of terrestrial plants are especially important. Some factors influencing the transfer of the fission products in the food chains are mentioned. (auth)

**43597** POTASSIUM CONCENTRATIONS OF MILK FROM VARIOUS PROVINCES. Madelmont, C.; Michon, G. (Centre d'Etudes Nucleaires, Fontenay-aux-Roses, France). Bull. Acad. Vet. France., 38: 135-8(Apr. 1965). (In French).

The potassium concentration of milk from different provinces was measured using the $^{40}K$ isotope for $\gamma$ spectrometry. The analysis of the results showed variations with regional differences and seasonal variations. The reasons for the regional and seasonal variations could not be determined as data over a long enough period of time were not available. (J.S.R.)

**43598** MONITORING AND CONTROL OF THE RADIOACTIVITY OF THE WATERS USED FOR AGRICULTURAL PURPOSES. **Bougnol, M. Bull. Tech. Genie Rural, No. 71, 1-63(Jan. 1965). (In French).**

The present state of the radioactive contamination of waters was summarized, principally to show the variety of the contamination. The behavior of radioactive elements in the water is described. Emphasis is placed on the dangers that these radioisotopes have for animal and plant organisms. The necessity of installing an efficient and generalized monitoring system is stressed. Apparatus for the continuous measurement of radioactivity available in the common market are critically studied. The construction and use of such installations is considered from an economic viewpoint. The possibility of a fruitful collaboration between the departments responsible for radioactive water contamination and those responsible for monitoring its contamination is suggested. (tr-auth)

**43599** PHYSICAL AND CHEMICAL CLEANLINESS OF SURFACES IN NUCLEAR TECHNIQUES AND APPLICATIONS. Dore, R. Corros. Anti-Corros., 14: 221-32 (July 1966). (In French).

The necessity of surface cleaning operations in all fields, especially in nuclear and aerospace applications is discussed. The methods used for obtaining and checking cleanliness are described. (R.C.K.)

**43600** MEDICAL CONTROLS OF RADIATION EXPOSURE LABORATORIES. Strambi, E. (CNEN, Casaccia, Italy). Folia Med. (Naples), 48: 73-87(1965). (In Italian). (RT-PROT-(65)34).

The importance of including prophylactic, therapeutic, and administrative aspects with diagnosis in the legislative definition of medical controls for radiation laboratories is stressed. Criteria for medical examination of radioisotope personnel are discussed. Medical problems generated by cases of severe external exposure or by radioactive contamination of personnel are considered. (TCO)

**43601** COMPARISON OF METHODS OF MEASURING RADIOACTIVITY (TOTAL $\beta$) IN RIVER WATER. Block, Wolfram; Lotz, Waltraud (Bundesanstalt fuer Gewaesserkunde, Coblenz). Gas-Wasserfach, 106: 679-82(June 1965). (In German).

**Three different methods for the measurement of total $\beta$ activity of river water were compared. The three methods yield almost the same error and have equal sensitivities. Statistical differences could be detected which could not be traced to working errors and which lie far outside the measurement error limits. The differences must be based in the processing and sampling methods, but it was not possible to clarify these differences through suitable experiments. (tr-auth)**

**43602** PROBLEMS OF RADIATION HYGIENE. **Nevstrueva, M. A. Gig. Sanit., No. 12, 3-6(1965). (In Russian).**

Problems of present-day radiation hygiene are reviewed. The determination of standards for various types of ionization radiation in case of their individual action or in combination with environmental factors of a nonradiational nature is considered. Soft x-rays are considered one of the most immediate problems. Various aspects of the problem of the radioactive waste burial are discussed. (auth)

**43603** MAXIMUM PERMISSIBLE CONCENTRATIONS OF THORON ($^{220}Rn$) AND ITS DAUGHTER PRODUCTS IN THE AIR OF WORKING PREMISES. **Gusarov, I. I.; Schepot'eva, E. S.; Andreev, S. V. (Central Inst. of Physiotherapy, Moscow). Gig. Sanit., No. 4, 44-8(Apr. 1966). (In Russian).**

On the basis of the calculations performed and data published, new values of maximum permissible concentrations of thoron and its daughter products in the air of working premises and a more convenient form of sanitary hygienic assessment of the air contamination with thoron daughter products are suggested. (auth)

**43604** PRECISION OF RADON ESTIMATION USING THE METHOD OF $^{226}Ra$ DETERMINATION IN HUMAN BODY BY THE AMOUNT OF RADON EXHALED. **Malykhin, V. M.; Reznik, G. S. (Inst. of Scientific Research Radiation Protection, USSR). Gig. Sanit., No. 4, 49-52 (Apr. 1966). (In Russian).**

Quantitative assessment of the fall in precision of radon estimation due to statistical relation of the nuclear chain dissociation is discussed. It is shown that for long-term estimations, it is necessary to determine the relative error and regulate properly the total time necessary for the estimation. (auth)

**43605** $^{90}Sr$ AND $^{89}Sr$ DOSE ESTIMATES FOR THE FETUS AND INFANT. **Mays, Charles W.; Lloyd, Ray D. (Univ. of Utah, Salt Lake City). Health Phys., 12: 1225-36(Sept. 1966).**

Doses to the young human skeleton were calculated using three models. Our best values for infant dose following a single ingestion of 1 $\mu C$ $^{90}Sr$ or 1 $\mu C$ $^{89}Sr$ by a pregnant woman at 6 or 9 months gestation or by a child at 6 or 12 months age are (in rads):

| Age at intake | $^{90}Sr$ dose, one year | $^{90}Sr$ dose, lifetime | $^{89}Sr$ dose, lifetime |
|---|---|---|---|
| 6 mo. gestation | 0.5 | 0.6 | 0.15 |
| 9 mo. gestation | 0.8 | 1.8 | 0.16 |
| 6 mo. parturition | 2.3 | 8.5 | 0.32 |
| 12 mo. parturition | 1.3 | 6.8 | 0.17 |

It is hoped that these estimates of skeletal dose are correct within a factor of 3 or better. Our values for skeletal dose are compared with corresponding values from the Federal Radiation Council assuming that in the infant, the dose to the skeleton (bone plus marrow) is twice the marrow dose. (auth)

**43606** THE NATURAL RADIATION DOSE TO INDIGENOUS RODENTS ON THE MORRO DO FERRO, BRAZIL. Drew, Robert T.; Eisenbud, Merril (New York Univ.).

Contract AT(30-1)-3086. Health Phys., 12: 1267-74(Sept. 1966).

The feasibility of studying the dose from natural radioactivity received by indigenous rodents in remote areas has been demonstrated on the Morro do Ferro, a large hill in Minas Gerais, Brazil. The abnormally high ambient gamma radiation, 1 m above the ground, ranges from 0.05 to 3.2 mR/hr, and is due to the presence of thorium in the soils and rocks. Estimates were made of the dose from external gamma radiation, internally deposited $^{226}$Ra and $^{228}$Ra, and inhalation of $^{220}$Rn, $^{222}$Rn, and their daughter products. The techniques used to obtain these data in the field and laboratory are described. External gamma exposure was measured by releasing trapped rodents into which fluoroglass rod dosimeters had been implanted subcutaneously. The dosimeters were removed after retrapping about 5 weeks later and indicated that the average dose over a several week period ranged from 0.15 to 0.76 mrad/hr, equivalent to 1.3–6.7 rad/yr. The bone dose from $^{228}$Ra has been estimated by radiochemical analysis, the preliminary results of which indicate concentrations of 0.7 to 2.8 pC/g bone ash leading to a dose in the order of 3 rem/yr. Estimates of the dose from inhalation of the radioactive noble gases were made using field measurements of the $^{222}$Rn and $^{220}$Rn content of air aspirated from rodent burrows. It was found that the $^{220}$Rn concentrations vary from near normal levels to $10^{-4}$ $\mu$C/ml. The problems involved in calculating the dose to the lung and other organs from $^{220}$Rn and $^{222}$Rn inhalation are discussed and preliminary data are given. Using alternative methods of calculation, the dose to the lung tissues is estimated to be in the range of $3 \times 10^3$ to $3 \times 10^4$ rem/yr. (auth)

**43607** GAMMA SPECTROMETRY OF NEUTRON-ACTIVATED SOILS. Nishita, H.; Steen, A. J.; Wood, R. A. (Univ. of California, Los Angeles). Contract AT(04-1)-GEN-12. Health Phys.. 12: 1299-1305(Sept. 1966).

The changes in the gamma spectra of soils neutron-irradiated in UCLA Engineering Reactor were followed up to 8883 hr. Although the soils studied differed widely in their physical and chemical characteristics from an agronomic point of view, their gamma spectra were quite similar, indicating similar chemical composition with respect to activation analysis. In general, with the progressive decay of various radioisotopes the gamma spectra of the several soils passed through a number of rather clearly defined conformations associated with a relatively few radioisotopes which prevail at a given time. These conformations were attributable to a sequence of certain dominant radioisotopes during the study period as follows: $^{56}$Mn, $^{56}$Mn/$^{24}$Na, $^{24}$Na, $^{24}$Na/$^{140}$La/$^{46}$Sc/$^{59}$Fe, $^{46}$Sc/$^{59}$Fe/$^{60}$Co, $^{46}$Sc/$^{60}$Co/$^{134}$Cs, and $^{60}$Co/$^{134}$Cs/$^{152}$Eu. The radionuclides, identified within the limits of this work, were $^{56}$Mn, $^{24}$Na, $^{140}$La, $^{46}$Sc, $^{59}$Fe, $^{60}$Co, $^{134}$Cs, $^{152/154}$Eu, $^{86}$Rb, $^{131}$Ba, and $^{42}$K. (auth)

**43608** ENVIRONMENTAL MONITORING OF $^{131}$I IN SMALL CONCENTRATIONS AND SOME COMPARISONS WITH METEOROLOGICAL CALCULATIONS. Hull, Andrew P. (Brookhaven National Lab., Upton, N. Y.). Health Phys., 12: 1317-25(Sept. 1966). (BNL-9432).

Four environmental monitoring stations are operated at locations on the perimeter of Brookhaven National Laboratory, about 2.5 km distant from the Brookhaven Graphite Research Reactor (BGRR) stack. During 1964 high volume samplers containing particulate and charcoal filters in sequence were operated at these stations. The BGRR cooling-air effluent contains about 8 mC/day of $^{131}$I in a concentration of $7 \times 10^{-10}$ $\mu$C/cc, apparently originating from fuel element surface contamination of 1 $\mu$g/ft$^2$. Using improved techniques of gamma spectroscopy, annual average concentrations between $4 \times 10^{-15}$ $\mu$C/cc and $1 \times 10^{-16}$ $\mu$C/cc were measured at the perimeter stations. These ranged between 200 and 15 per cent of those calculated for these locations by the BNL Meteorology Group. A concentration of $^{131}$I of $7.2 \times 10^{-13}$ $\mu$C/cc was measured on 28–29 October 1964, in a single day peak of air activity attributable to the Chinese weapons test of 16 October. Grass concentrations of between 1.0 and $3.0 \times 10^{-7}$ $\mu$C/g were found during the next 2 weeks. An $^{131}$I deposition velocity of 0.25 ± 0.10 cm/sec was calculated from the initial deposition. A concentration of 32 pC/l was found on 1 November in a nearby milk supply. This concentration decreased over the next few weeks with a 4.8 day "effective" half-life. From 12–16 November about 300 mC of $^{131}$I vapor was inadvertently released by the Hot Laboratory from the BGRR stack. The measured integrated air concentrations at the three stations downwind for some portion of the release ranged from twice to one-half of those predicted for short-duration releases. (auth)

**43609** ELECTRONIC DATA PROCESSING METHOD FOR RAPID ASSESSMENT OF POTENTIAL OFF-SITE RADIOLOGICAL EFFECTS. Hawley, C. A. Jr.; Detmer, J. E.; Edwards, Lois A. (Atomic Energy Commission, Idaho Falls, Idaho. Univ. of Michigan, Ann Arbor). Health Phys., 12: 1356-62(Sept. 1966).

In evaluating the results of a release of radioactive material, two major facets must be considered; the nature of the release and the composition of the affected population segment. The major objective of the project was to acquire specific information to be used in hazards evaluations which would include dose estimates. The data collection system was designed to facilitate direct translation into punched cards for data processing. Programs for handling the data were written in Fortran with Format for the IBM 1620 computer. A flow diagram for the data processing system is presented. The collected data would have immediate value should a major accident involving release of radioactive material at NRTS occur. (R.C.K.)

**43610** RESEARCH ON RADIO CONTAMINATION IN HOKKAIDO. PART 6. DETERMINATION OF $^{90}$Sr CONTENT IN MILK AND MILK POWDER. Ando, Yoshiaki (Hokkaido Inst. of Public Health, Japan). Hokkaidoritsu Eisei Kenkyushoho, No. 15, 98-100(Nov. 1965). (In Japanese).

Measurements were made of $^{90}$Sr content in skim milk powders collected twice during 1963–1964 from six plants in Hokkaido. $^{90}$Sr values for 12 samples ranged from 30.7 to 78.5 $\mu\mu$C per 100 g of wet sample. Nagasawa et al. have reported that the values of the $^{90}$Sr content of 21 samples collected from 7 plants located in various parts of Japan during 1962–1963 ranged from 3.5 to 14.2 $\mu\mu$C per 100 g of wet sample. Therefore, it is recognized that the level of $^{90}$Sr contamination in milk powders produced in Hokkaido was several times higher than in those produced in the other localities. Measurements were also made of $^{90}$Sr in grass. Seasonal variation was found in both the $^{90}$Sr contents of milk and grass, each of which showed a maximum in November 1963. (auth)

**43611** IGNITION OF URANIUM. Baker, L. Jr.; Schnizlein, J. G.; Bingle, J. D. (Argonne National Lab., Ill.). J. Nucl. Mater., 20: 22-38(July 1966).

Experimental studies are reported of the ignition of pure U. Most of the experiments were performed by placing the metal samples in a flowing oxidizing atmosphere within a furnace whose temperature was increasing at the rate of 10°C/min. The ignition temperature of the sample was determined graphically from the sample temperature-time record as the point of intersection between extensions of the pre-ignition heating rate and the post-ignition self-heating rate. The ignition temperature of 8.5-mm cubes of U from three sources (in air and in $O_2$) was very close to 600°C; however, characteristic differences in reaction were apparent in the 400 to 500°C range. Ignition temperature decreased with sample size. It was concluded that U ignitions in air and $O_2$ are thermal ignitions which can be explained in terms of a balance of heat losses and heat generated by the oxidation reaction. (J.R.D.)

**43612** IGNITION OF BINARY ALLOYS OF URANIUM. Schnizlein, J. G.; Baker, L. Jr.; Bingle, J. D. (Argonne National Lab., Ill.). J. Nucl. Mater., 20: 39-47(July 1966).

A study is reported of the effect of alloying additions on the ignition of U. The experiments were performed by placing nominal 8.5-mm alloy cubes in a flowing oxidizing atmosphere within a furnace whose temperature was increasing at the rate of 10°C/min. Differences in the sample temperature-time curves were noted for binary U alloys containing 0.5, 1, and 2 at. % of 24 different elements. Results were interpreted in terms of the effect of the alloying addition on the previously demonstrated transition of the oxide at 400 to 500°C. (J.R.D.)

**43613** RELATIVE DOSIMETRIC MEASUREMENTS OF A WELL IRRADIATOR. **Cechacek, Zdenek; Hillova, Jana (Inst. of Biophysics, Brno). Jad. Energ., 12: 180-3(1966). (In Czech).**

The $^{60}$Co well irradiator at the Brno Biophysics Institute had a strength of 2035 curies when installed in October 1962. It is used for irradiating animals and various organic and inorganic materials. Entire objects may be irradiated homogeneously. Water shielding protects personnel from any radiation hazard, which is better than in other types of irradiators. In June 1965 its strength was calculated to be 1439 curies. Measurements were then made, with a Fricke dosimeter of field strength along the diameters and axis of the well, of the shielding effect of the water at various depths, and of the radiation intensity in the irradiation vessels. These are reported in tables and graphs. The irradiator is described, and the results are concluded to show that the irradiator is satisfactory but that the dose should be made more homogeneous for irradiation of large animals and that special preparation is necessary for irradiation of biological samples. (TTT)

**43614** OCCUPATIONAL RADIATION EXPOSURES IN THE GERMAN DEMOCRATIC REPUBLIC IN 1964. **Brasack, G.; Kraus, W. (Staatliche Zentrale fuer Strahlenschutz, Berlin). Kernenergie, 9: 194-7(June 1966). (In German).**

The results of dosimetry of 16,762 persons professionally exposed to radiation in 1964 are reported. A survey of monthly overexposures (more than 0.4 rad) as well as of the distribution of annual exposures is given. The results of the 1963 survey are compared to those of 1964, which follow the same statistical treatment for the annual exposures. Some information is given on how to improve radiation protection. It is estimated that the situation concerning the occupational exposures in the G.D.R. is adequate. (tr-auth)

**43615** ENVIRONMENTAL CONTAMINATION WITH $^{95}$Zr–$^{95}$Nb IN JAPAN. **Yamagata, Noboru; Iwashima, Kiyoshi (Inst. of Public Health, Tokyo). Koshu Eiseiin Kenkyu Hokoku, 14: 137-47(Sept. 1965).**

Measurements on $^{95}$Zr–$^{95}$Nb in airborne particles, surface soil, land waters, sea-water, foodstuffs, and complete diet between October 1961 and the beginning of 1964 are summarized. The external dose from these nuclides deposited on the ground was more than ten times that from long-lived nuclides in the peak fallout period March–June, of comparable order in November–December, and negligible after the beginning of 1964. The estimated average lung burden was 220 pC for the period concerned, and the value for fractional long-term deposition in lungs was estimated as 0.15 assuming no biological elimination from lungs. The main route of dietary intake was through fresh leafy vegetables, contributing up to 80% or more. The daily dietary intakes can be assessed by analysis of an indicator foodstuff such as spinach. Some of the marine organisms such as shellfish and seaweed were found to concentrate these nuclides by a factor of up to several thousands. (auth)

**43616** LOCALIZATION OF RADIATION SOURCES FOR DOSAGE CALCULATION IN INTERSTITIAL RADIUM THERAPY. I. PRESENTATION OF SOME RADIOGRAPHIC TECHNIQUES. Bonati, P.; Cugini, A. (Univ., Turin). Minerva Radiol., Fisioterap. Radiobiol., 11: 327-40(June 1966). (In Italian).

Methods must be available for localizing radiation sources in interstitial therapy so that the physical dose can be calculated. Details are given of the radiographic double impression method and the localizing box method. The theoretical bases of each method are presented and their practical application is illustrated by discussion of tests made on a cranium phantom with a radiation implant. The results are not evaluated. (tr-auth)

**43617** INHALATION HAZARDS OF RADON DECAY PRODUCTS IN URANIUM MINES. **Schiager, Keith J. (Colorado State Univ., Fort Collins). Nucl. News, 9: No. 6, 21-3(June 1966).**

Hazards from inhaling radon decay products in uranium mines were studied in human subjects exposed to known aerosol conditions in the Schwartzwalder uranium mine near Golden, Colorado. The basic technique employed was the comparison of the amounts of radon decay products deposited at various locations in the respiratory tract with the amounts of the same products collected by various types of air sampling instruments. Measurement of respiratory tract activity was accomplished by a gamma-ray spectrometer using a mobile counter patterned after the Hanford Mobile Whole-Body Counter. Air samples were analyzed by both alpha and gamma spectrometry. No correlation was found between activity collected in a midget cyclone sampler to that collected on the back-up membrane filter with the ratio of activity measured in the trachea region to that measured in the lung region. Inadequate collimation was believed to be responsible for much of the discrepancy. Physiological variation in respiratory patterns among individual subjects and within the same subject was identified as another source of discrepancy. (H.G.D.)

**43618** EFFECT OF REACTIVITY ADDITION RATE AND OF WEAK NEUTRON SOURCE ON THE FISSION YIELD OF URANIUM SOLUTIONS. **Hankins, Dale E. Nucl. Sci. Eng., 26: 110-16(Sept. 1966). (LA-DC-7585).**

The fission yield of an accidental assembly of a supercritical volume of uranyl nitrate solution will depend on several variables, two of which are discussed here: the rate of reactivity addition, and the effect of the weak-neutron flux in the solution. Fission yields for a 53 g/liter uranyl nitrate solution subjected to various rates of reactivity addition were calculated. The small number of neutrons from the solution will cause the excursion to occur after the assembly has reached a critical mass and has become slightly supercritical. The effect of the delay in initiation on the fission yield of the assembly is calculated with curves of the probability of initiation vs time. The effect on the fission yield of different neutron source strengths, the addition of sodium carbonate to the solution, and changes in the uranium concentrations of the solutions are discussed. A comparison is made of the predicted values obtained from these calculations and the reported yields from six accidental excursions. (auth)

**43619** CHRONIC ACCUMULATION OF $^{90}$Sr IN A HUMAN BODY AS PREDICTED FROM THE RETENTION OF SINGLE DOSE OF A TRACER. **Liniecki, Julian (Inst. of Occupational Medicine, Lodz, Poland). Nukleonika, 11: 383-92(1966).**

On basis of power function of strontium retention $R(t) = At^{-b} = 0.6t^{-0.24}$ and of data on the absorption efficiency of this element from gastro-intestinal tract, $^{90}$Sr concentration in bones of adults, as expected from contamination of the diet in 1954–1963, is calculated for New York City, Poland and Great Britain. Good agreement with direct measurements is apparent. Problem of possible incorrectness of extrapolation of the power function beyond the time-range of direct observation is discussed. Conclusion is reached that uncertainty in the extrapolation is of very little importance for prediction of $^{90}$Sr accumulation in the body under conditions of chronic intake. (auth)

**43620** DOSE ESTIMATION TO ACTIVE BONE MARROW IN MEDICAL USES OF IONIZING RADIATION. **Biagini, C. (Univ., Sassari, Italy); Cavallo, F.; Siciliano, A.; Monosi, A.; Brancadoro, P. Nunt. Radiol., 31: 1149-64(Nov. 1965). (In Italian).**

The fundamental criteria concerning the evaluation of the dose at the bone marrow in the medical use of the ionizing radiations are illustrated. After a survey of the literature on this subject, an original method is described for the evaluation of the dose at the active bone marrow in $\gamma$-

teletherapy. The quantitative distribution of the hemopoietic marrow in the area crossed by the radiation beam was obtained with a stratified human phantom and by applying the values published by Ellis. Isodose tables concerning the various irradiation procedures were used to analyze dose distribution. An example of practical application of the method is reported. (tr-auth)

**43621** DOSE CALCULATION OF $^{60}$Co SLAB IRRADIATOR. Oshima, Yunosuke (Japan Atomic Energy Research Inst., Tokyo). Oyo Butsuri, 35: 417-23(June 1966). (In Japanese).

Dose distribution from a $^{60}$Co slab irradiator for industrial use is calculated as a function of the distance from the irradiator. For a rectangular slab source, an approximate calculation can be made by assuming the source to be of a hypothetical form that can easily be treated mathematically. Two types of schematic models are conceived for the calculation of dose distribution: in the vicinity of the source, the slab source is assumed to be of an infinite length; away from the source, the source is assumed to be of a rod of a finite length. The measured values agree with the values calculated by taking the self-absorption of the source into account. The distribution of dose absorbed in water of semi-infinite dimension that comes in contact with one side of the source is also calculated. (auth)

**43622** RADIONUCLIDES IN ALASKAN ESKIMOS. Hungate, F. P.; Hanson, W. C.; Kornberg, H. A. (General Electric Co., Richland, Wash.). pp 16-26 of Science in Alaska. Dahlgren, George (ed.). Alaska Division of American Association for the Advancement of Science, 1965. (CONF-640819-2).

Alaska has less fallout than many other areas of the United States, yet the Alaskan Eskimos have a higher content of cesium-137 than the average U.S. population. The amount is generally dependent on the consumption of caribou meat. Radiation doses to these Eskimos average less than 0.2 rad per yr with a predicted 30-yr cumulative dose of less than three rad. This cumulative dose is less than the expected dose from cosmic and other natural radiation sources. No damage to man or animals has been detected at such a low dose rate. Strontium-90 and other fallout nuclides apparently contribute little to the Eskimos' total radiation dose. Surveillance will be continued to ensure adequate information on doses received and to add to knowledge of basic processes involved. (C.O.)

**43623** RADIOACTIVE DECONTAMINATION BY ULTRASONICS. Wells, H. Ultrasonics, 4: 29-34(Jan. 1966).

The removal of radioactive contaminants from metal surfaces can be improved using ultrasonic energy with certain cleaning solutions. Laboratory studies show that ultrasonics improves decontamination when cleaning is done with detergents, acids, or complexing agents. The intensity of ultrasonic energy appears to be the most important parameter with a minimum intensity of about 3.5 w/cm$^2$ being necessary to obtain significant improvement over the use of the cleaning agent alone. Under good conditions, ultrasonics improves decontamination by a factor of 10 or more. (TSS)

**43624** METHODS FOR MONITORING THE RADIOACTIVITY OF WATERS. Aurand, K. Berlin, Freie Univ., 1965. 55p. $2.00 Gmelin, AED-Diss. 65-274. Thesis.

New methods of sampling for continuous water monitoring are described. A sampler for surface waters for sampling times up to 1 month operates without external power using air streaming through a capillary. Samplers for sewer channel and tap water monitoring are described. A system for drinking water concentrates the sample continuously by evaporation. Results of fall-out measurements in waters 1963–64 in Berlin are given. (Gmelin Inst.)

**43625** VOPROSY OBSHCHEI RADIOBIOLOGII. (Problems of General Radiobiology). Domshlaka, M. P. Moscow, Atomizdat, 1966. 304p.

The twenty-seven articles of this book are concerned with the following topics: methods and techniques used in gamma radiation studies and dosimetry; data on radiosensitivity of living organisms; characteristics of radiobiological effects and radiosensitivity of various organs; biological effects of proton radiation; radiobiological importance of dosage, length of exposure, and ultrafractionation. (R.V.J.)

**43626** UMWELTRADIOAKTIVITAET UND STRAHLENBELASTUNG. Bericht I/66. (Environmental Radioactivity and Radiation Burden. First Quarterly Report, 66). Bad Godesberg, Ger., Bundesminister fuer Wissenschaftliche Forschung, 1966. 164p. DM 8.-.

A report is given on the content of radioactive material in air, water, soil, and food and the radiation burden of the population in the German Federal Republic. The report is given in cooperation with laboratories authorized by the federal government. Results are presented in graphic and tabular form. (H.L.W.)

**43627** BERYLLIUM: ITS INDUSTRIAL HYGIENE ASPECTS. Stokinger, Herbert E. (ed.). American Industrial Hygiene Association and U. S. Atomic Energy Commission Monograph Series on Industrial Hygiene. New York, Academic Press, 1966. 394p. $11.60.

Separate abstracts were prepared on ten chapters that discuss various aspects of beryllium toxicity and industrial hygiene for the beryllium industry. A list of 911 references is included. (C.H.)

*For abstracts of individual chapters see: 42751–42756, 43107, 43108, 43628, and 43629.*

**43628** OCCUPATIONAL HEALTH ASPECTS. Breslin, A. J. pp 245-321 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.

Health aspects of occupational exposure to Be are discussed. Various industrial uses of Be and Be compounds are reviewed and the potential of each for the exposure of workers is discussed. Monitoring methods are described and the cost of the engineering phases of health protection are discussed. (32 references.) (C.H.)

**43629** COMMUNITY ASPECTS. Breslin, A. J. pp 329-55 of Beryllium: Its Industrial Hygiene Aspects. Stokinger, Herbert E. (ed.). New York, Academic Press, 1966.

The proper treatment of exhaust air carrying Be is equal in importance to the correct use of air in controlling contamination in the working environment. Procedures for the monitoring of out-of-plant air, stack monitoring, and the monitoring of solid and liquid waste disposal are described. Regulations governing the shipment of Be-containing materials are reviewed. (14 references.) (C.H.)

**43630** AEROSOL STUDIES AND THE RELEVANCE OF AIR SAMPLING TO PERSONNEL EXPOSURE IN A PLUTONIUM LABORATORY. Palmer, G. H. (Atomic Energy Establishment, Winfrith, Eng.). 12p. (CONF-650616-22). ORAU. Gmelin, AED-CONF-65-153-34.

From Health Physics Society, Annual Meeting, Los Angeles.

Problems arising from work in a laboratory manufacturing experimental plutonium oxide/uranium oxide type reactor fuels in moderate quantities are summarized: measures are introduced to control the hazards; and personnel exposure to plutonium-containing aerosols is assessed. The main health physics problem was one of inhalation of plutonium dusts arising from slight damage to the neoprene gloves used in the glove boxes. Installed conventional type air samplers grossly underestimated individual exposure. Personal air samplers gave a much better indication of the amount of inhaled material although estimates of intake were rather high. Presently, monitoring of the workers hands immediately upon withdrawal from the glove box is the quickest way to detect a glove fault. Fecal analysis is a highly efficient method for establishing plutonium oxide inhalation, but urinalysis gives no indication whatever. (H.G.D.)

**43631** LOCAL TISSUE DOSE FROM INSOLUBLE PARTICLES OF $^{90}$Sr. Caldwell, Roger D.; Clement, Joseph D. (Nuclear Materials and Equipment Corp., Apollo, Pa.). 17p. (CONF-650616-29). ORAU. Gmelin, AED-CONF-65-153-50.

From Health Physics Society, Annual Meeting, Los Angeles.

Hazards from soluble and insoluble particles of $^{90}$Sr as strontium titanate are compared by evaluating dose factors from particles lodged in the lung or pulmonary lymph nodes and from transit through the gastrointestinal tract. A method is presented for calculating local tissue dose from insoluble particles. It is concluded that a given amount of insoluble $^{90}$Sr may be more hazardous when inhaled than the same amount of soluble Sr. (H.G.D.)

**43632** PUBLIC HEALTH EVALUATION OF NUCLEAR POWER PLANTS. Weaver, Charles L. (Technical Operations Branch, Washington, D. C.); Stigall, Garry E.; Gaeta, Neil A. 26p. (CONF-650616-31). ORAU.

From Health Physics Society, Annual Meeting, Los Angeles.

The potential effect on the public health and the environment from the proposed operation of major nuclear reactor facilities is now being evaluated by the Nuclear Facilities Environmental Analysis Section of the Division of Radiological Health of the Public Health Service on a routine basis. In the past year several reactors in the 1200 to megawatt thermal (MW(t)) power level have been evaluated prior to the start of construction. Using several power reactors as typical examples, the role of the Public Health Service in providing assistance to State health agencies on potential environmental problems is discussed. This type of evaluation of stationary reactor installations is specifically directed to meet the needs of State and local public health and other agencies which have responsibilities related to the proposed construction and subsequent operation of nuclear power plants. (auth)

# INSTRUMENTATION

## General

*Refer also to abstracts 43561, 43960, and 44920.*

**43633** (K-1632(Pt.1)) A GRAVIMETRIC GAS FLOW STANDARD. PART I. DESIGN AND CONSTRUCTION. Collins, W. T.; Selby, T. W. (Oak Ridge Gaseous Diffusion Plant, Tenn.). May 18, 1965. Contract W-7405-eng-26. 68p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

A versatile standard for measurement of gas flow has been designed and constructed. The design is based on use of a gravimetric technique in which the time required to collect a given mass of air in a weighing bottle is determined. Equal-arm balances of 2 and 50 kilogram capacity are used to weigh the mass of air collected. The balances have been modified to operate automatically using servo-operated chain weights, and are remotely controlled from a central control console. Cylindrical weighing bottles having fiberglass-epoxy filament wound walls are used to collect the air samples. The largest bottle weighs about 44 kilograms (366 liter volume) and the smallest weighs about 1 kilogram (3 liter volume). Design criteria and construction features are discussed. Current estimates of the uncertainties indicate that the mass flow rate can be determined to ±0.1 percent over the range of 0.06 to 1650 grams of dry air per minute. (auth)

**43634** (SLAC-PUB-199) REFINEMENTS IN PRECISION KILOVOLT PULSE MEASUREMENTS. Fowkes, W. R.; Rowe, R. M. (Stanford Linear Accelerator Center, Stanford Univ., Calif.). June 1966. Contract AT(04-3)-400. 35p. (CONF-660637-1). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Conference on Precision Electromagnetic Measurements, Boulder, Colo.

Techniques for reducing errors encountered in measuring the amplitude of 100–300 kv pulses which are a few microseconds in length are described. The accuracy to which such measurements can be made depends, for the most part, on how precisely the behavior of the voltage dividing network is shown. Problems due to stray reactances, temperature, voltage effects, dielectric and dimensional instabilities, losses, improper terminations and external circuitry are dealt with, with particular emphasis on capacitive voltage dividers. Also described briefly are an ultrastable laboratory standard divider, calibration techniques, and measuring instrumentation. (auth)

**43635** (UCRL-12484(Rev.2)) METHOD FOR DETERMINING THE RESPONSE OF TEMPERATURE SENSORS TO A RAPID TEMPERATURE RISE. Parker, Robert (Lawrence Radiation Lab., Univ. of California, Livermore). Apr. 28, 1966. Contract W-7405-eng-48. 11p. (CONF-661004-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Instrument Society of America, Fall Meeting, New York.

A capacitor discharge technique was used to pulse heat a metal strip very quickly (30 μsec) and the response of a temperature sensor bonded to the strip was measured, to give the temperature response of the sensor. The analytical solution for the response of the sensor was compared with the experimental data, with very good agreement. It was concluded that the glue-line and backing thicknesses govern the response of the sensor. A possible nondestructive method for determining the response of a temperature sensor and a strain gage, to be used in the field on a structure encountering pulse heating, is proposed. (auth)

**43636** (UCRL-14993) EFFECT OF PRESSURE ON THE TEMPERATURE CALIBRATION OF Mo/Mo-50 Re THERMOCOUPLES TO 1000 DEG C AND 60 KILOBARS. Stromberg, H. D.; Stephens, D. R. (Lawrence Radiation Lab., Univ. of California, Livermore). July 15, 1966. Contract W-7405-eng-26. 14p. (CONF-661102-3). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

For Presentation at American Society of Mechanical Engineers, Winter Annual Conference, New York.

The effect of pressure on the emf of Mo/Mo–50% Re thermocouples was compared to that of Cr/Al. The pressure effect compared to Cr/Al was small, about 7°C at 40 kbar and 1000°C. It is believed that strain on thermocouple wires caused by deformation in high-pressure systems has a significant effect on the measured temperatures. For example, it has been reported that Cr/Al thermocouples will read as much as 8°C low at 700°C after cold work. This effect may explain differences in the reported pressure dependence of emf for Cr/Al thermocouples. One-atmosphere emf temperature calibrations also are given for Mo/Mo–50% Re and for Re/Mo–30% Re thermocouples. (auth)

**43637** (UCRL-16246, pp 168-75) ULTRACENTRIFUGE ROTOR TEMPERATURE AND SPEED MEASUREMENT BY RADIO TELEMETRY. Fabricant, Stephen J.; Lindgren, Frank T. (California Univ., Berkeley. Donner Lab. California Univ., Berkeley. Donner Pavilion).

The principles of radio telemetry were applied in achieving a unique solution to the problem of analytic ultracentrifuge rotor temperature measurement, eliminating the necessity for a direct electrical connection to the rotor. A small transmitter operating in the standard FM band and powered by batteries is mounted in a fixture that is bolted to the rotor. The frequency of the transmitter is a function of rotor temperature, and the amplitude of the received carrier is dependent on the angular relationship of the transmitter to a pickup loop mounted several inches below the rotor. This composite AM and FM signal is detected by an ordinary FM tuner. The output of the FM detector is read on a voltmeter or a recorder as temperature; the AM signal is counted by an electronic counter to display rotor speed in digital form. This system is capable of repeatable temperature measurements accurate to ±0.05°C after appropriate calibration. Also, the system has been used in conjunction with a heater in a feedback loop to provide accurate temperature control of the rotor during the analytical run. (auth)

**43638** (UCRL-70018) ALICE MACHINE TAPE-RECORDER DATA ACQUISITION SYSTEM. Waugh, A. F.; Maxwell, C. J. (Lawrence Radiation Lab., Univ. of California, Livermore). Sept. 23, 1966. Contract W-7405-eng-48. 16p. (CONF-661016-15). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Symposium on Engineering Problems of Controlled Thermonuclear Research, Gatlinburg, Tenn.

A multichannel, instrumentation-type, tape recorder used together with a multichannel light beam oscillograph has proven very satisfactory as the main data acquisition and reproduction system for the Alice machine experiment. The Alice machine, with its magnet-on time of up to 20 sec and neutral beam injection period of 3 to 10 sec, is neither a d-c machine or a pulsed machine. During the trapping time of several seconds it is impossible to capture all of the available data by oscilloscope camera methods, although this was the method relied on prior to the use of the tape recorder. Now, nearly all the signals of interest are simultaneously and continuously recorded and reproduced by the tape machine onto the oscillograph during the entire injection interval and decay time which follows. This initial analog, hard-copy printout is immediately available after each shot for comparison of relative amplitudes and envelope shapes. Any part of this record can then be subsequently reproduced at different tape and chart speeds to obtain the time resolution desired. The 14-channel tape recorder with its direct mode frequency response to 250 Hz to 300 kHz and fm mode frequency response of 0-40 kHz can operate at any of the standard eight speeds from $^{15}/_{16}$ ips to 120 ips. The maximum chart speed of the oscillograph instrument is 100 ips. With the maximum frequency reduction capability of 128/1, a 40-kHz signal can be reproduced as a 312-Hz signal and printed at a very readable 3.12 cycles per inch. At present the tape recorder is mounted on a portable base, together with a full rack of auxiliary equipment including the following, in addition to the oscillograph: Multiple-gain-step signal-conditioning voltage amplifiers, galvanometer amplifiers, a calibration signal source, and timing sequence controls and input patch panels for all of the above, making it a complete versatile, self-contained data acquisition and reproduction system. (auth)

**43639** (AEC-tr-6633) HANDBOOK OF AUTOMATIC CONTROL INSTRUMENTS WITH ISOTOPE SOURCES. Korotkov, L. I. Translation of Spravochnik po Radioizotopnym Priboram Dlya Kontrolya i Avtomatizatsii Tekhnologicheskikh Protsessov, Gosatomizdat, Moscow, 1963. 212p. (IPST-Cat.-1506). Dep. CFSTI $6.00 cy, $1.25 mn.

Design and operational characteristics of isotopic level, thickness, density, concentration, moisture, and pressure gages used in Russia for the automatic control of industrial processes are discussed. Geophysical equipment such as gamma flaw detectors and gamma therapeutic equipment are not included. (F.S.)

**43640** A DEVICE FOR IMPROVING THE SIGNAL-TO-NOISE RATIO OF NMR SPECTRA. **Huck, P. J.; Homer, J. (Univ. of Aston, Birmingham, Eng.). Chem. Ind. (London), No. 35, 1488-90(Aug. 27, 1966).**

The problem of detecting weak nuclear magnetic resonance (NMR) signals and improving the signal-to-noise ratio (S/N) is discussed. The principle of the technique proposed involves, successively, integration at a fixed point in the spectrum, reading only the final integrated signal, stepwise scan, and integral cancellation, each operation being carried out for an accurately known and constant time. A Perkin-Elmer R10 60 Mcps instrument was modified to perform repeatedly these operations controlled by commercial timing equipment. The schematic diagram for the system and the behavior of the relays governing the successive basic operations are shown. The timing equipment (with fast reset time of 0.1 sec and timing accuracy of 2%) is housed in a separate console designed as a plug-in accessory to the spectrometer and connected to it by screened coaxial cables. While both point integration and reduced-band-width slow-sweep methods give S/N improvements consistent with those expected, an important advantage of the former is that it requires only minor modifications to the spectrometer whereas for the latter they may be extensive. One further practical advantage of the former method was found empirically. This is that r-f level and possible associated saturation effects appear to influence the production of good S/N spectra by the point integration method less critically than by the reduced-band-width slow-sweep method. (BBB)

**43641** MULTICHANNEL ANALYZERS FOR NUCLEAR MEASUREMENTS. Pajares, J. A. (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid), 10: 127-44 (Mar.-Apr. 1966). (In Spanish).

The characteristics, limitations, and present development of amplitude and time multichannel analyzers are summarized. The fundamental constituents of the most typical multichannel analyzers are described. (J.S.R.)

**43642** RADIOISOTOPES USED FOR MEASURING THICKNESS IN METALLURGY. Maugest, J. Energ. Nucl. (Paris), 8: 267-72(June 1966). (In French).

Gamma rays are principally used in the control of laminated strips in metallurgy. The accuracy of a radioelement gage depends on the instrumentation used, the precision, the rapidity of measurement, and on a careful choice of the energy from the radiation source activity. The two general methods of measurements, analog and digital, are examined as well as the technological characteristics of the gages and the sources and detectors of radiation. (auth)

**43643** APPARATUS FOR SIMULTANEOUS RECORDING OF PULSE DENSITY AND TIME RATE OF BROAD DETECTOR SIGNALS WITH A SINGLE-LINE COMPENSATOR. **Schulze, Horst W.; Renker, Karl (Institut fuer Angewandte Radioaktivitaet, Leipzig). Exp. Tech. Phys., 13: 442-6(1965). (In German).**

In work with radio-labeled substances it is occasionally necessary to measure, in addition to the pulse rate produced by the substance and recorded by the radiation detector, an additional magnitude modifying the pulse rate. If both magnitudes vary with time, an attempt is made to record them simultaneously. This problem has special significance in the gas chromatography of radio-labeled substances where both the concentration of the substance in the carrier gas current and also the pulse rate produced by it in its passage through the radiation detector could be recorded. (tr-auth)

**43644** DISMOUNTABLE PULSE TUBE FOR THE NANOSECOND TECHNIQUE. **Eckardt, A.; Prager, R. (Friedrich-Schiller-Univ., Jena, Ger.). Exp. Tech. Phys., 13: 475-80(1965). (In German).**

For studies of photomultipliers and the testing of pulse circuits in the nanosecond range, a hydrogen-filled pulse transmitting tube was developed. Continuing operations of this tube resulted in amplitude fluctuation, which was eliminated by electrolytic polishing of the electrode circuits. A dismountable pulse tube was constructed to simplify the polishing of the electrodes. The characteristics of this tube are given. (J.S.R.)

**43645** NUCLEAR INSTRUMENTATION IN LOW-ENERGY PHYSICS. **Sarazin, Armand (Univ., Lyon); Samueli, Jean-Jacques. Ind. At., 10: No. 7-8, 55-60(1966). (In French).**

Recent progress in developing electronic instruments for processing data obtained from nuclear detectors is discussed. The problems of linear electronics, and more specifically the measurements of energy and time, are taken up from the point of view of ascertaining the limits of resolution, and then a rapid study is made of the possibilities of the digital processing of data. (auth)

**43646** A SIMPLE, AUTOMATIC DEVICE FOR X-RAY INTEGRATED INTENSITY MEASUREMENTS ON SAMPLES UNDERGOING IRRADIATION. **Colella, R.; Koechler, C. (CCR-EURATOM, Ispra, Italy). J. Sci. Instrum., 43: 670-1(Sept. 1966).**

An automatic control device is described, which allows the integrated x-ray intensity from a given set of crystallographic planes of a sample under irradiation to be measured at equal intervals of time. (auth)

**43647** CALCULATIONS FOR GAMMA-RAY SCATTERING IN DENSITY GAGE. Uemura, Teiji (Industrial Research Inst., Osaka). **Jap. J. Appl. Phys., 5: 900-2 (Oct. 1966).**

Calculations of three problems for a surface density meter utilizing a $^{137}$Cs gamma-source are dealt with: (a) variation of the scattered intensity due to air-gap between the gage and scatterer; (b) dependence of the thickness at saturated intensity on the density of scatterer; (c) dependence of the scattered intensity from each section of the source and the detector side on both the density and the source-to-detector separation. The calculations are based on the scattering and absorption properties of matter with regard to gamma rays, in a similar method as described in a previous paper. The computations of integrals for partial space are numerically done following the Simpson's one-third rule. The previous observations can be explained satisfactorily by the results of calculations. (auth)

**43648** HIGH-SENSITIVITY RADIO-FREQUENCY MASS SPECTROMETER FOR INVESTIGATING THE IONIC AND NEUTRAL COMPOSITION OF THE UPPER ATMOSPHERE. **Pavlenko, V. A.; Zarkhin, B. I.; Rafal'son, A. E.; Slutskii,**

M. E. Kosm. Issled., 4: 457-62(May-June 1966). (In Russian).

An MKh6407M high-sensitivity radio-frequency mass spectrometer, intended for analyzing the ionic and neutral composition of the upper atmosphere, is described. The device is characterized by high partial sensitivity, power requirements of 3 w for the ion analysis mode of operation and 5 w for the neutral analysis mode, and small size (2.5 kg). The spectrometer consists of two analyzers, one for the range 1–4 amu and the other for 12–50 amu, and the electronic unit. The partial sensitivity of the light mass analyzer to $H_2$ is $3 \times 10^{-11}$ mm Hg and that of the medium mass analyzer to A is $1 \times 10^{-11}$ mm Hg. The basic circuit of the analyzer and a block diagram of the spectrometer are also presented and discussed. Typical spectra are shown, and the basic characteristics of the mass spectrometer are listed. (ATD)

**43649** DYNAMIC BEHAVIOR OF TUNNEL DIODE MONOSTABLE CIRCUITS. Abbattista, N.; Coli, M.; Plantamura, V. L. (Istituto di Fisica, Bari, Italy. CNEN, Frascati, Italy). Nucl. Instrum. Methods, 44: 29-38 (Sept. 1966).

The dynamic behavior of tunnel-diode monostable circuits is analyzed as a function of a characteristic circuit parameter. The analysis is developed in a general way and special emphasis is given to the problems of fast nuclear electronics. The analysis refers to circuits with current gain larger than one and to those performing only logic operations. It is also comparative between circuits with linear and nonlinear biasing. Tunnel-diode circuits biased very near to the peak are regarded with a view to stability for multiple switching; this is in fact the most important limit for high-sensitivity monostable circuits. Experimental results are compared with theoretical calculations. (auth)

**43650** SOLID STATE NANOSECOND PULSER USING MARX BANK TECHNIQUES. Jung, E. A.; Lewis, R. N. (Argonne National Lab., Ill.). Nucl. Instrum. Methods, 44: 224-8(Oct. 1966).

This pulser generates a 5 kv pulse into 50 ohm, 17 nsec after receiving a $\frac{1}{3}$ v input signal. The voltage is derived from capacitors which are charged in parallel and discharged in series. Avalanche transistors are used as the switching elements from the 0 to 1 kv level, while Elkonite spark gaps are used from the 1 to 5 kv level. Pulse repetition rates in excess of 100 pps are readily obtainable and output pulse jitter is less than 1 nsec. (auth)

**43651** NEW PULSE HEIGHT COMPENSATOR FOR TIME TO AMPLITUDE CONVERTERS. Thieberger, P. (Brookhaven National Lab., Upton, N. Y.). Contract AT(30-2)-Gen-16. Nucl. Instrum. Methods, 44: 349-52 (Oct. 1966). (BNL–10039).

The pulse height dependence of the time measurement performed by a time-to-amplitude converter is canceled by using correcting signals from a second converter to which slow pulses from the detectors are fed. A maximum displacement of the prompt curve of $3 \times 10^{-11}$ sec is obtained over a pulse height range of ratio 1 to 5.5 for both detectors. (auth)

**43652** GENERATOR OF A SEQUENCE OF RANDOM PULSES. Kuzmichev, V. N. (Higher Naval Radio Electronics, USSR). Prib. Tekh. Eksp., No. 2, 86-7(Mar.-Apr. 1966). (In Russian).

A circuit was designed to generate a sequence of rectangular periodic pulses whose amplitudes change according to the law of random processes. The circuit of the generator is presented. (B.G.D.)

**43653** A DEVICE FOR SPECTRAL MEASUREMENTS OF LOW-FREQUENCY PHOTOCURRENT NOISES IN SEMICONDUCTORS. Lukyanchikova, N. B.; Garbar, N. P. (Inst. of Semiconductors, Kiev). Prib. Tekh. Eksp., No. 2, 178-9(Mar.-Apr. 1966). (In Russian).

An instrument is described for studying the spectra of photocurrent noises in the frequency range from 1 cps to 5 kc. The device has an extremely low inherent noise level response. A block diagram of the installation is presented. (B.G.D.)

**43654** ELECTRONIC COUNTERS USING TUNNEL DIODES AND TRANSISTORS. Klimov, V. V.; Kovalin, Ya. V. (Mathematical Inst., Sverdlovsk, USSR). Prib. Tekh. Eksp., No. 3, 95-7(May-June 1966). (In Russian).

Two counter circuits, an accumulator and a ring counter, are described. Although they both utilize tunnel diodes, the counting frequency of both is 300 kc. In the first counter, trigger flip-flops are formed by low frequency transistors P14 and tunnel diodes with peak current equal to 2.4 ma. For reliable operation, the triggering pulses must be narrow and for this reason the RC differentiator circuits are used for interstage coupling. The second circuit is a ring counter. It consists of tunnel diode flip-flops with transistor amplifiers. Zener diodes are used to prevent transistor saturation. They increase the flip-flop sensitivity threshold and speed up the flip-flop reset action. Two outputs from the ring counter are available: voltage level output from the tunnel diodes, and pulse output from transistor collectors. This counter makes use of tunnel diodes with a peak current equal to 5.5 ma, D808 Zener diodes, and P403 and P503 transistors. (ATD)

**43655** HIGH-VOLTAGE NANOSECOND PULSE GENERATOR. Geltsel, M. Yu.; Panfilov, A. D.; Panasyuk, V. S.; Sobolev, S. S.; Yudin, L. I. Prib. Tekh. Eksp., No. 3, 101-7(May-June 1966). (In Russian).

A high-voltage pulse generator is described which develops 5–50 nsec square pulses of up to 50 kv with rise times from 1 to 5 nsec. The basic circuit consists of a thyratron, anode pulse-forming line, and a cathode output featuring a coaxial line with square-loop ferrite as a nonlinear pulse-forming element. Another feature of the circuit is the balanced-T form of line termination, which has one arm shorted and the other terminated in a small lumped capacitance, providing a reflection-free pulse output. If the pulse were used, for example, to gate a particle beam passing between plane electrodes, the inherent capacity of the electrodes could act as the required terminating load. Design parameters, including coupling and matching refinements, are treated at length. Circuit stability is rated good, with a firing-time jitter of not worse than 1 nsec rms. (ATD)

**43656** STABILIZED POWER SUPPLY FOR ELECTRON-OPTICAL CONVERTERS WITH REGULATED OUTPUT VOLTAGE. Korobkin, V. V.; Malyavkin, L. P.; Shchelev, M. Ya. (Inst. of Physics, Moscow). Prib. Tekh. Eksp., No. 3, 145-8(May-June 1966). (In Russian).

A power supply for electron-optical converters was designed. The power supply is of modular construction and it has two floating outputs. One output may be continuously varied from 4 to 22 kv at a load current of 250 μamps. The voltage stability is 0.05% and the ripple does not exceed 0.01%. The second output is also variable from 0 to ±250 v. It is intended for electron-optical converters with electrostatic focusing. The voltage stability is 0.1% and the ripple is less than 0.03% at a load current of 500 μamps. The supply has a common rectifier section giving out unregulated voltages of 140, 30, and 50 volts. These are further regulated by transistor-Zener diode regulators and applied to two dc/dc converters. The high voltage output is derived from a voltage doubler circuit at the output of a dc/dc converter. The 250 v output section is a conventional full-wave bridge circuit. The primary power is a 220 v ±10% source. The weight of one such module is 3 kg. (ATD)

**43657** USING MAGNETIC-FIELD PULSE MODULATION FOR RECORDING THE ORIGINAL FORM OF NMR AND EPR SPECTRA. Tomashevskii, E. E.; Egorov, E. A.; Savostin, A. Ya. (Inst. of Physics and Tech., Leningrad). Prib. Tekh. Eksp., No. 3, 156-7(May-June 1966). (In Russian).

Modulation of magnetic field by high-amplitude pulses (exceeding the absorption range) is suggested for the purposes of recording original NMR and EPR spectra. The method results in a 100% modulation of the absorption signal and ensures, without line-shape distortion, a higher sensitivity as compared to the method of small sinusoidal modulation. The direct record of the original spectrum enhances accuracy in calculating absorption-line momenta. The method, first suggested by B. E. Holder et al. (Phys. Rev., 1955, 98, 1, 265), involves the signals modulated by trapezoid pulses having a repetition rate of a few dozen pulses per second and a duty factor of 0.5; simultaneously, a slow linear sweep of the magnetic field is performed. NMR spectra of polymethyl methacrylate and an EPR spectrum of DPPH are shown. The method is applicable to standard NMR wide-line spectrometers as well as to superheterodyne-type EPR spectrometers. (ATD)

**43658** MASS-SPECTROMETER OUTFIT FOR STUDYING THE INTENSITY DISTRIBUTION OF MOLECULAR BEAMS IN SPACE. **Lyubitov, Yu. N.; Ivanov, Yu. M. (Moscow Inst. of Steel and Alloys). Prib. Tekh. Eksp., No. 3, 160-2(May-June 1966). (In Russian).**

The development is reported of a special outfit consisting of a mass spectrometer and a special chamber. The chamber houses a molecular gun with a mechanism for moving it with respect to the ionization space of the spectrometer. The molecules emerging from an evaporation cell enter an ionization box at right angles to electron and ion beams. The driving mechanism is explained. The angular distribution of $^{24}$Mg particles emerging from a cylindrical effusion crucible is shown, as is the curve of beam-density distribution over the cross section of the crucible port. The ion-current measurement error is 3% or less. The outfit operates at pressures 0.0001–1 torr in the molecule source. Furnace-temperature stability is 1°/hr or better within 300–1000°C. (ATD)

**43659** INFLUENCE OF THE NATURE AND OF THE ENERGY OF AN ION BEAM ON THE GAIN OF AN ELECTRON MULTIPLIER USED IN MASS SPECTROMETRY. **Hoffert, F.; Paulus, J.; Adloff, J. P. (Centre de Recherches Nucleaires, Strasbourg). Rev. Phys. Appl., 1: 43-7 (Mar. 1966). (In French).**

The variation of the gain of an electron multiplier used as a collector on an Atlas $CH_4$ mass spectrometer was measured as a function of energy, atomic mass number, structure, and charge of incident ions. The variation of gain with energy was linear between 1 and 5 kv for rare gas ions, the slope decreasing with increasing atomic number of the rare gas. Isotopic ions of Ne, Ar, Kr, Xe, Cl, Br, and Hg fall on the same curve when variation in gain is plotted against ion velocity. Variation of gain with atomic number gives a curve which rises sharply until Ne, but only slightly between Ar and Kr. At equal velocity the gains measured for a polyatomic ion and monoatomic ion, or for polyatomic ions with differing numbers of atoms, diverge from a common value. At equal velocity the gain for a singly charged ion of a given element is greater than that of the doubly charged ion, and the difference increases with velocity. Between 1 and 2 kv the gain is practically constant for ions of any structure if they have the same velocity. (BBB)

**43660** METHOD FOR STUDYING SPUTTERED PARTICLES BY EMISSION SPECTROSCOPY. **Sawatzky, Erich; Kay, Eric (IBM Research Lab., San Jose, Calif.). Rev. Sci. Instrum., 37: 1324-9(Oct. 1966).**

An f/6.8 scanning spectrometer with a photomultiplier output was used to monitor the presence of particles sputtered from a target surface by ion bombardment. The ion source was a conventional duoplasmatron providing a high density, high energy ion beam. The density of sputtered particles available for analysis was of the order of $10^8$ $cm^{-3}$. A fraction of these particles was electronically excited by a high density, low energy electron beam, and the emission spectra characteristic of the target material were recorded with either an electrometer or a phase sensitive detector. Some intense atomic copper lines were easily observed when a Cu target was bombarded with 5000 ev $Ar^+$ ions. The intensities of these lines were analyzed to obtain the sputtering yield and some relative excitation functions for copper. A comparison between the conventional mass spectrometric technique and the present scheme is presented. (auth)

**43661** RAY PROOF SLIT MOUNT FOR X-RAY POWDER DIFFRACTOMETERS. **Parrish, W.; Vajda, I. (Philips Labs., Braircliff Manor, N. Y.). Rev. Sci. Instrum., 37: 1406-7(Oct. 1966).**

A slit mount is described for coupling an x-ray tube to a diffractometer which minimizes radiation hazards in x-ray diffractometers. The slit mount is safe up to the highest voltage tested (60 kv d-c constant potential). (B.G.D.)

**43662** INVESTIGATION OF RADIOMETER (RD-1C) EFFICIENCY FOR FLOW RATE MEASUREMENTS. **Dimaksyan, A. M. Tr., Gos. Gidrol. Inst., 130: 163-83 (1965). (In Russian).**

The principal effects of an improved device for measuring water flow rates by the radioactive method were examined. The results of laboratory and field studies of the device in measurements of flow velocities down slopes and low velocities in streams closed by ice are reported. The results from measurements of water discharge and movement in soils are also given. Questions connected with the selection of radioactive indicators and the possibilities of their introduction in various media were examined. (tr-auth)

**43663** TWO-CELL CALORIMETER (Engineering Materials). **(Argonne National Lab., Ill.). (CAPE–1462). 1 drawing.**

A steady-state differential calorimeter is used to measure gamma heating in materials being irradiated in a reactor. The instrument is dependable and accurate. It can be used either in a beam hole or a vertical facility. (F.S.)

**43664** STANDARD NUCLEAR INSTRUMENT MODULES /Q-2800 **(Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE–1477).** 45 drawings.

The modules comply with specification drawings for 5¼ and 8¾ in. standard modules developed and adopted by the AEC Committee on Nuclear Instrument Modules. The modules can be assembled easily with simple hand tools. Components are fabricated from extruded Al bars and angles, die cast Al, and sheet Al. Shields are of Cd plated brass. Any or all Al components or assemblies of components may be die cast Al if all dimensional tolerances are met. The bin has space for 12 single-width modules and a ⅝ in. wide power panel. The power panel provides space for mounting an a-c power switch, pilot light, and voltage test points. All module design details are dimensioned in both in. and mm. (For details see TID-4100 Suppl. 37) (F.S.)

**43665** PROCEEDINGS OF INSTRUMENT SOCIETY OF AMERICA SEVENTH NATIONAL POWER INSTRUMENTATION SYMPOSIUM, DENVER, COLORADO, MAY 18, 19, 20, 1964. **ISA (Instr. Soc. Amer.), Proc., Nat. Power Instr. Symp., 7: 1-169(1964). (CONF-629).**

Seventeen papers are presented on the development, implementation, and operation of instrumentation and control systems for power generating equipment. Major topics covered include boiler safety systems, simulation systems, analog and digital controls, and transducer development. A separate abstract was prepared for one paper and one paper was abstracted previously as NSA 18: 40920. (H.D.R.)

*For an abstract of the individual paper see: 45168.*

## Radiation Detection

*Refer also to abstracts 43096, 43106, 43591, 44718, 45028, and 45044.*

**43666** (AD–623557) NUCLEAR SAFETY. Annotated Bibliography. **Valiunas, Andrew; Poplawski, Bartholomew (Aerospace Technology Div., Library of Congress, Washington, D. C.). Oct. 22, 1965. 65p. (N–66–11853; ATD-B–65–76). CFSTI $3.00 cy, $0.75 mn.**

This annotated bibliography contains 235 references to Soviet literature on radiation detectors, radiation shielding, remote-handling equipment, and radiation protective devices. (C.H.)

**43667** (AD-639694) A SOFT ELECTRON SPECTROMETER FOR AURORAL RESEARCH. Scientific Report No. 5. Stout, D. F. (Utah Univ., Salt Lake City. Upper Air Research Lab.). Aug. 1966. Contract AF19 (628)-4995. 94p. (AFCRL-66-604; UU-66-9). CFSTI $3.00 cy, $0.75 mn.

A few of the problems associated with the measurement of electron directional flux inside an aurora by a rocket probe are analyzed. The trajectories of electrons with energies between 40 ev and 10 kev are studied and their interference with the rocket is examined. It is found that a serious measurement problem exists if the electron detection device is mounted incorrectly on the rocket. Secondary electrons below 1 kev energy are also found to be a problem. A partial solution to these problems is presented; and since the problems cannot be completely eliminated, a few methods are proposed to correct the erroneous data which they cause. A design procedure for an instrument capable of obtaining an electron spectrum by electrostatic selection is shown. Deflection plates with cylindrical geometry are found to offer certain advantages for the present system. The resulting deflection system geometry is able to resolve 6 bands of electron energies with band centers at 59.3, 149, 362, 910, 2275, and 5680 ev. A new device, the curved channel electron multiplier, is used to detect individual electrons. A brief outline of its theory of operation is presented and the advantages of this multiplier for sounding rocket experiments are also discussed. (auth)

**43668** (ANL-7136, pp 1-16) DOSIMETRY. (Argonne National Lab., Ill.).

Results are reported from measurements of fast neutron and $\gamma$ dose rates in the exposure rooms of the Janus Biological Research Reactor. The use of computers to measure absorbed doses resulting from fast neutrons of various energies in tissues of variable composition is discussed. The sensitivity and accuracy of low-temperature calorimetric $\gamma$ and neutron absorbed dose measurements in tissues was demonstrated. A schematic sketch of the dynamic liquid-helium probe cryostat assembly and calorimeter used for these measurements is included. The calibration of the NaI(Tl) $\gamma$ scintillation system to provide linear response when used to count distributed sources in biological materials is described. A convenient calibration source derived from natural Tl was used which avoids the problems inherent in the use of sum peaks. Applications for two geometric problems are described. A sensitive, convenient, and rapid system for ferrous-sulfate dosimetry in the range 50 to 1500 R and a ceric sulfate fluorometric system which is usable in the range 50 to 1500 rads are described. (C.H.)

**43669** (CONF-661001-4) CALIBRATION OF A LARGE PROTON RECOIL DETECTOR FOR FAST NEUTRON SPECTRA MEASUREMENTS. Augustson, R. H.; Gaerttner, E. R.; Gozani, T.; Kaushal, N.; Malaviya, B. K.; Winhold, E. J.; Yergin, P. F. (Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Nuclear Engineering and Science). [1966]. Contract AT(30-3)-328. 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

The efficiency of a large proton recoil detector as a function of neutron energy was determined by two independent methods: one based on the photonuclear spectrum of the deuteron and the other involving a smaller calibrated scintillation detector. A comparison of the efficiency over the energy range from 0.7 to 10 Mev shows good agreement. (B.G.D.)

**43670** (INR-693/I/PL) AN ELECTRONIC PULSE MULTIPLIER FOR IDENTIFICATION OF CHARGED PARTICLES. Turos, A.; Zieminski, A. (Institute of Nuclear Research, Warsaw (Poland)). Mar. 1966. 16p. Dep.

A simple, low cost electronic pulse multiplier for identification of charged particles with different mass and/or charge is described. The well known relation $4XY = (X + Y)^2 - (X - Y)^2$ is a basis for getting the product of two electrical signals. The square law operations on the (X + Y) and (X − Y) values are performed for this purpose by specially developed diode square function generators. The circuit is capable of handling input pulses as narrow as 0.5 $\mu$sec with the accuracy of the product of 1%. (auth)

**43671** (ORNL-P-2467) THE PRESENT STATUS OF NEUTRON MONITORING FOR PERSONNEL PROTECTION. Auxier, J. A. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 27p. (SM-76-67; CONF-660807-4). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Symposium on Neutron Monitoring for Radiological Protection, Vienna, Austria.

Developments in neutron dosimetry during the past twenty years are reviewed including: scintillation systems; cylindrical or spherical moderators with thermal neutron detectors located on the axes or at the centers; proportional counters; solid-state detectors; thermoluminescent and photoluminescent systems; liquid ionization chambers; and the use of heavy ion tracks in insulating solids. It is speculated that the most significant change in the field of radiological monitoring will be the substitution of solid-state devices for the film and nuclear emulsions in personal dosimeters, and it is foreseen that solid-state detectors and operational analyzers will be used for measurements of absorbed dose, LET, and other parameters. (H.G.D.)

**43672** (ORNL-P-2471) PROTON-RECOIL NEUTRON SPECTROMETRY WITH ORGANIC SCINTILLATORS. Verbinski, V. V.; Burrus, W. R.; Freestone, R. M.; Textor, R. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 22p. (SM-76-13; CONF-660807-5). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Symposium on Neutron Monitoring for Radiological Protection, Vienna, Austria.

The possibility of using an organic scintillator as a proton-recoil neutron spectrometer is very attractive because of its high efficiency, large size, high speed, and gamma-ray discrimination capability. Its disadvantages, including nonlinear light yields to heavy particles and smeared step-like responses to monoenergetic neutrons, have been largely overcome in the two spectrometry techniques reported here. Response functions were obtained for NE-213 scintillators from Monte Carlo calculations for pulse-height distributions for monoenergetic neutrons of 0.1 to 20 Mev. Measured values of detector resolution and light yields for protons, alpha particles, and carbon ions were used in the calculation. Proton leakage from the scintillator was considered. Absolute experimental checks of the Monte Carlo calculations were made at 2.66 and 14.43 Mev with the associated particle method. These showed better than 5% overall agreement. In one spectrometry technique the family of response functions is used as input data for a spectrum unfolding code which unfolds experimental pulse-height distributions to obtain complex neutron spectra. The code is based on quadratic programming and utilizes the known nonnegativity of the neutron spectrum. An energy range of 0.7 to 18 Mev was covered with this method when pulse height distributions corresponding to 0.4 to 18 Mev proton-recoil energies were used as input to the code. In the other technique, utilizing time-of-flight methods, each response function was integrated above the discriminator level to obtain the scintillator efficiencies necessary for calculating energy spectra. With both experimental techniques, a modified Forté gamma-ray discriminator was used. It accepted neutrons from 0.25 to 20 Mev and operated effectively with 5 mr/hr of $^{60}$Co gammas irradiating a 5-cm by 5-cm diam scintillator (50 mr/hr for a 2-cm diam by 1 cm scintillator). A few techniques are presented for eliminating two sources of spurious counts from the gamma-ray pulse-height distribution, thus making it possible to measure neutron and gamma-ray dose simultaneously with a single detector. Several proposed methods of neutrons and gamma ray dosimetry are outlined. (auth)

**43673** (PPAD-596-E) USE OF THE MULTISPHERE NEUTRON DETECTOR FOR DOSIMETRY OF MIXED RA-

DIATION FIELDS. Awschalom, Miguel (Princeton–Pennsylvania Accelerator, Princeton, N. J.). Aug. 5, 1966. Contract AT(30-1)-2137. 47p. (CONF-660807–6). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Symposium on Neutron Monitoring for Radiological Protection, Vienna, Austria.

The energy response of the spherical neutron detectors with $^6$LiI crystals has been described by Bonner and Hankins. These detectors have been used at the PPA in complete sets together with a muscle tissue equivalent chamber in an attempt to improve the accuracy of mixed radiation dosimetry. The multisphere method is used in conjunction with a computer to estimate the neutron field parameters. Two of these parameters are the dose and dose equivalent delivered by the neutrons. Although the method of spectrum unfolding is discussed and the results of unfolding monochromatic and some continuous spectra are presented, the energy spectrum is used only to calculate total dose and total dose equivalent, using data published by various authors. The results are evaluated from the point of view of dose estimates. All estimates of dose equivalent per detector count are shown for 20, 25, and 30 cm spheres. Finally, a word about the relative merits of iron and lead as shielding materials for high energy neutron shielding and collimation, is given in the light of neutron spectra obtained bombarding Al, Fe, Pb and depleted U-238 with Bev neutrons. (auth)

**43674** HOMOGENEOUS NUCLEATION AND GROWTH OF DROPLETS IN VAPORS. Feder, J. (Univ. of Oslo); Russell, K. C.; Lothe, J.; Pound, G. M. Advances Phys., 15: No. 57, 111-78(Jan. 1966).

The theory of homogeneous nucleation of liquid drops in supersaturated vapors is reviewed. A new kinetic treatment which accounts for the heating of the growing clusters due to the latent heat of condensation is presented, and the irreversible thermodynamics of nonisothermal nucleation discussed. It is found that growing clusters are generally colder than the surrounding vapor during their sub-critical growth period. Time dependent nucleation is discussed and a simple estimate for the time-lag in establishing the steady state is given. The nucleation in cloud chambers expanding with constant speed is discussed in detail, and the number of droplets formed and their final mean size is calculated as a function of the terminal expansion ratio. Re-evaporation of nucleated clusters is discussed. Numerical results are given for a number of typical situations in experiments on water-vapor. These results for the nucleation rate as corrected by Lothe and Pound predict much lower "critical" expansion ratios than indicated by the limited experimental data available, even when the nonisothermal theory is used. To restore agreement between theory and experiments the surface tension for small droplets ($\simeq$100 molecules) could be increased some 15% above that of the bulk liquid, or the pre-exponential in the nucleation rate could be decreased by some $10^{-15}$. This latter expedient roughly corresponds to use of the "classical" instead of the Lothe-Pound nucleation rate. These two alterations would, however, affect the theoretical curves in different manners and careful experiments could possibly distinguish between them. (auth)

**43675** EVALUATION OF QUENCH CORRECTION IN LIQUID SCINTILLATION COUNTING BY INTERNAL, AUTOMATIC EXTERNAL, AND CHANNELS' RATIO STANDARDIZATION METHODS. Rogers, A. W.; Moran, J. F. (State Univ. of New York, Buffalo). Anal. Biochem., 16: 206-19(Aug. 1966).

The methods of internal standardization, channels' ratio, and automatic external standardization were compared using a series of samples of tritiated water and varying amounts of a quenching agent. The careful addition of internal standard is shown to give the highest accuracy in determination of the efficiency of liquid scintillation counting. The technique of channels' ratio is equally accurate, when used with samples that are moderately quenched and have a high counting rate, but is time-consuming for samples with a low counting rate, and less accurate for highly quenched samples. Automatic external standardization is considerably less accurate than either of the other techniques. (auth)

**43676** OPTICAL PROCESSING OF BUBBLE CHAMBER PHOTOGRAPHS. Falconer, David G. (Conductron Corp., Ann Arbor, Mich.). Appl. Opt., 5: 1365-9(Sept. 1966).

The processing of bubble chamber photographs has emerged as a major task in the experimental study of subatomic decays and interactions. Although electronic computer techniques have proved useful in reconstructing the geometry and ascertaining the kinematics of high-energy events, the scanning and measuring of bubble chamber photographs has remained for the most part unautomated. An alternate approach to the computerization of the scan-measure task is through the newly developed optical computer, a device which accepts input data on photographic film and thus obviates the need for digitizing photographs before processing. The optical computer can aid the scan-measure task by suppressing beam tracks, measuring track widths, and determining scattering angles. (auth)

**43677** A NEW IONIZING RADIATION DETECTION CONCEPT WHICH EMPLOYS SEMICONDUCTOR AVALANCHE AMPLIFICATION AND THE TUNNEL DIODE ELEMENT. Locker, Robert J.; Huth, Gerald C. (General Electric Co., Philadelphia). Appl. Phys. Lett., 9: 227-30 (Sept. 15, 1966). (TID–23223).

A concept for the detection of ionizing radiation which utilizes the inherent high speed and large amplitude of the induced charge pulse in a semiconductor avalanche detector coupled with the tunnel diode element is described. It was shown possible to digitally detect extremely low energy events even in high-current-induced noise backgrounds in the avalanche detector. Cryogenic cooling is not required. Detection is accomplished by use of the rate of rise and magnitude of the nuclear pulse (or alternatively a pulse of suitable amplitude and rate of rise generated by optical photons). The high-speed time domain allows discrimination against all noise-generated events because charge is not integrated in this scheme. (auth)

**43678** DIRECTIONAL RESPONSE OF COSMIC RAY TELESCOPES. Lindgren, Stig. Ark. Geofys., 5: 23-9 (1966).

A study was made of the directional response of a number of muon telescopes as far as the response depends on purely geometrical properties, i.e., in case the muon intensity is isotropic at the instruments. The results are presented graphically. A comparison of telescopes made up of circular detectors with those consisting of square detectors shows that the two types, if appropriately matched, can replace each other without any appreciable change of directional response. (auth)

**43679** GLASS-BASE DOSIMETERS WITH OPTICAL DENSITY CHANGES INDUCED BY RADIATION. Byurganovskaya, G. V.; Gvozdev, E. G.; Khovanovich, A. I. At. Energ. (USSR), 21: 38-41(July 1966). (In Russian).

A review is given of the composition and sensitivity of glass dosimeters, based on the measurement of the optical density under irradiation. The basic dosimetric characteristics of the $\gamma$ dosimeter SGD-8 and the $\gamma$-neutron dosimeter L-15 are described. These dosimeters were prepared with a sodium- and lithium-silicate glass base with additives of nickel. They can determine irradiation doses from tens to a million roentgens. (tr-auth)

**43680** IONIZATION CHAMBER WITH SILVER ELECTRODES FOR MEASURING THERMAL NEUTRON FLUXES UNDER HIGH LEVEL GAMMA IRRADIATION. Kukarin, A. I.; Khovanovich, A. I. At. Energ. (USSR), 21: 49-50 (July 1966). (In Russian).

A design is given of an ionization chamber constructed with 5-mm thick organic glass. Using silver electrodes prepared with silver foil consisting of a natural mixture of $^{107}$Ag(51.9%) and $^{109}$Ag(49.1%). After thermal neutron capture these isotopes are converted to $^{108}$Ag and $^{110}$Ag with a half life of 2.3 min and 24.5 sec, respectively. The working ionization volume of the chamber is 80 cm$^3$, and the silver electrode weight is 77g. The current dependence on the time following irradiation by the thermal neutrons $3 \times 10$'' neutron/cm$^2$ sec during a 5 minute interval is plotted. With shorter time of chamber irradiation, and increased voltage and current it is possible to measure thermal neutron fluxes of higher intensities. (R.V.J.)

**43681** SCINTILLATION SPECTROMETER FOR SIMULTANEOUS INVESTIGATION OF COMPETING NUCLEAR REACTIONS. Chuprunov, D. L.; Zazulin, V. S.; Mikhaleva, T. N. At. Energ. (USSR), 21: 50-1(July 1966). (In Russian).

A block scheme is given of a spectrometer with two AI-100 type multichannel analyzers capable of simultaneous recording of (p,p') and (p,$\alpha$) reactions without the presence of $\gamma$ background. The simultaneously recorded proton and $\alpha$-particle spectra for $^{27}$Al(p,$\alpha$)$^{24}$Mg and $^{27}$Al(p,p')$^{27*}$Al reactions and $^{23}$Na(p,$\alpha$)$^{20}$Ne and $^{23}$Na(p,p')$^{23*}$Na reactions are presented. The angular distributions of protons and $\alpha$ particles produced by proton reactions with aluminum nuclei at 30 to 165° angle and 6.24- to 6.74-Mev protons were measured as well as elastically and inelastically scattered protons at 1.0 to 6.7 Mev and 5.4 to 8.9 Mev $\alpha$ particles. Measurements with $\alpha$ particle beams accelerated on a cyclotron showed that at the given scheme the $\alpha$ particle energy interval recorded simultaneously with protons was 3 to 15 Mev. (R.V.J.)

**43682** 4$\pi$ BETA SPECTROMETER WITH LIQUID SCINTILLATOR FOR SAMPLES IN THE FORM OF DRY POWDER WITH LOW SPECIFIC ACTIVITY. Feuerhake, Inge; Hinzpeter, A. (Technische Hochschule, Hanover). Atomkernenergie, 11: 391-6(1966). (In German).

A 4$\pi$ scintillation spectrometer is described for application to beta emitting substances of low specific activity. Samples in the form of dry powder—e.g., ashes won by preparation of fallout from rainwater of air—are distributed in scintillating gel and regarded by two multipliers. Pulses are added and given to a multi-channel analyzer. The energy calibration is made by means of an external $\gamma$-source. Evaluating the pulse height distribution for any mixtures of beta emitters one may get the total activity of the sample by extrapolation to energy 0. Thus the errors of the usual counting methods are avoided. The real spectrum of beta sources with maximum energy not too low (some 100 kev), is gained to a sufficient exactitude in order to determine the average energy. Contaminations may be examined by this method within activities of 0.05 nCi. The samples may have quantities up to 3 g, if they are of a white color, otherwise if they are grey or brown, only ten mg may be measured. So the specific activities sufficient to gain the values for the activity and average energy within an accuracy of some percentages are in the range 5 to 0.02 nCi per g. Some beta spectra of fallout are reported. (auth)

**43683** SUMMATION SPECTROMETER AS A DETECTOR OF LINEAR GAMMA-RAY POLARIZATION. Kajfosz, Josef (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). Cesk. Cas. Fys., 16: 439-44(1966). (In Czech).

A gamma-ray polarimeter with symmetrical arrangement of the two scintillation detectors of the NaI type and with summation of the amplitudes of the coincidence impulses is described. By measuring the directional polarization correlation of a gamma-quanta cascade from $^{60}$Ni and $^{49}$Ti nuclei, its properties and use in studying radiation capture were verified. (auth)

**43684** THE STUDY OF HIGH ENERGY $\gamma$ RADIATION BY MEANS OF HIGH RESOLUTION PAIR SPECTROMETER. Huguet, Michel; Forest, Hugues; Ythier, Christian (Univ. Paris, Nice, France). Compt. Rend., Ser. B, 263: 79-82 (July 4, 1966). (In French).

A $\gamma$ pair spectrometer is described in which the detector is an p-i-n germanium diode; its coincidence circuit has a resolution time of 25 nsec. The energy resolution measured on the 2753.9-kev ray of $^{24}$Na is 8.4 kev. Several new $\gamma$ rays were detected in the spectra of $^{140}$La at high energy. (tr-auth)

**43685** DEVELOPMENT OF A HIGH-RESOLUTION NMR SPECTROGRAPH WITH AN INTENSE MAGNETIC FIELD. Sauzade, Michel; Taquin, Jacques; Girard, Bernard; Torre, Jean-Pierre (Univ., Paris, Orsay, France). Compt. Rend., Ser. B, 263: 477-80(Aug. 8, 1966). (In French).

A superconducting coil with a very homogeneous field was used to develop a high resolution NMR spectrograph. The principles which served as guides in the design of this spectrograph are discussed. (G.O.Y.)

**43686** APPLICABILITY OF ELECTRONIC DIFFERENTIATION OF CHARACTERISTIC CURVES OF PROBES. Arndt, R. (Institut fuer Gasentladungsphysik, Deutsche Akademie der Wissenschaften, Greifswald, Ger.). Exp. Tech. Phys., 13: 430-41(1965). (In German).

On the basis of examples of two characteristic phenomena it was shown that perturbation effects that alter their dimension in the cycle of the probe voltage produce a different pattern of the electronically obtained differential quotient from that determined from the I–U characteristic line. The generalized expressions derived and a brief consideration of some perturbation types showed that the method of electronic characteristic differentiation can be of significance in the evaluation of false probe characteristic lines. (tr-auth)

**43687** TELEMETERING OF PULSES FROM A SCINTILLATING COSMIC RAY DETECTOR OVER A WIDE DYNAMIC RANGE. Gadalov, A. N.; Rapoport, I. D.; Mineev, Yu. V. (Moscow State Univ.). Geomagn. Aeronomiya, 6: 762-6(1966). (In Russian).

A relatively simple system for measuring amplitude of pulses from a scintillation cosmic ray detector in the dynamic range of $\sim 2.10^4$ is described. This range is attained by means of an analog-to-numeric conversion directly at the output of a photomultiplier. The basic concept of the system is illustrated. An oscillatory circuit, tuned to f ~ 1 Mc (so that $1/f \gg \tau_1$ where $\tau_1$ is the luminescence time), is coupled to the anode circuit of the photomultiplier which registers scintillations ($\tau_1 \sim 10^{-9}$ sec). A photomultiplier current pulse charges the capacitor of the tank circuit and produces a packet of damped oscillations with an initial amplitude ($U_0$) proportional to the current pulse. The oscillations are damped and then passed on to an amplitude discriminator (threshold, $U_t$) which forms a packet of standard pulses whose number $N = k\ln(U_0/U_t)$. In the presence of an external control signal and through an anticoincidence circuit, these pulses are sent to an output counter whose readings are in turn transmitted to a registration channel. In the absence of the control signal, the circuit oscillations are damped by the first pulse that arrives from the discriminator through another anticoincidence circuit. In this case, the packet of pulses is not damped. Thus, a selection is made of registered pulses. The minimum value of the registered scintillation pulses is determined by the input circuit noise. The circuit sensitivity ($U_t$), which is made to exceed several times the noise level, is ~300 $\mu$v. The maximum value of registered scintillation pulses of ~7 v is limited by the permissible amplitude at the input of the transistorized circuits. The power supply required for the entire system does not exceed 100 Mw. (ATD)

**43688** A MONITOR FOR LOW-LEVEL $\beta$ RADIOACTIVITY IN REACTOR COOLING WATER. Quirk, E. J. M. (Aktiebolaget Atomenergi, Studsvik, Sweden). Health Phys., 12: 1333-46(Sept. 1966).

A detection system is described for the continuous monitoring of $\beta$ activity in the secondary cooling water at the Studsvik R2 Reactor. Radiation emanating from a water surface is measured by a large area gas proportional detector. The extent to which contamination affects the background counting rate has been studied for both continuous and discontinuous flow conditions. It is shown that for the duration of the tests described the continuous flow mode of operation results in freedom from the effects of contamination so long as the scaler live time is suitably chosen. Minimum detectable specific activities obtainable in practice extend from $10^{-6}$ $\mu$C/ml to $1.3 \cdot 10^{-8}$ $\mu$C/ml depending on the $\beta$ end-point energy in the range 167 kev–2.26 Mev. (auth)

**43689** RADIOPHOTOLUMINESCENCE DOSIMETRY: BIBLIOGRAPHY. Becker, K. (Juelich Nuclear Research Establishment, Ger.). Health Phys., 12: 1367-74(Sept. 1966).

A bibliography is presented on radiophotoluminescent silver-activated glasses. These glasses have excellent dosimetric properties which make them superior to many other dosimetric systems in routine and accidental personnel dosimetry, civil defense dosimetry, and for several special applications in radiobiology, medicine, and radioecology. About 250 references from report and published literature are given. (R.C.K.)

**43690** INFLUENCE OF LIMITS SET TO LATERAL DISPLACEMENT ON THE DETERMINATION OF MEAN MULTIPLE COULOMB SCATTERING IN NUCLEAR EMULSIONS. Aditya, Prem K. (Indian Inst. of Tech., New Delhi). Indian J. Phys., 40: 238-43(May 1966).

The multiple scattering constant was determined in nuclear emulsions using 8 Bev $\mu$-mesons. The influence of limits set on lateral scattering of tracks was investigated. It was shown that an underestimation to an extent of up to 25% may be introduced by restricting track displacements to say about 50 $\mu$m in 10 cm travel. Such limits are generally imposed upon by the requirements of having close pairs of tracks to avoid spurious scattering in relative scattering measurements or due to the limited width of the field of view of the microscopes and due to finite thickness of the emulsion layer. (auth)

**43691** ON THE POSSIBILITY OF IONIZATION MEASUREMENTS IN A STREAMER CHAMBER. Asatiani, T. L.; Gazaryan, K. A.; Zhmyrov, V. N.; Ivanov, V. A.; Matevosyan, E. M.; Nazaryan, A. A.; Filozov, A. F.; Sharkhatunyan, P. O. Izv. Akad. Nauk Arm. SSR, Fiz., 1: 127-30(1966). (In Russian).

The ionizing power of protons coming at 90° to the electric field was measured and the track brightness was shown to serve as a good parameter for measuring ionization in the streamer chamber. (auth)

**43692** APPLICATION OF DIFFERENT ORTHONORMAL EXPANSION METHODS TO NEUTRON MEASUREMENTS. I. ANALYSIS OF SPECTRA. Ryufuku, Hiroshi (Japan Atomic Energy Research Inst., Tokyo). Jap. J. Appl. Phys., 5: 903-9(Oct. 1966).

Approximate neutron spectra can be obtained from the counting rates of $BF_3$ proportional counters. The $BF_3$ counters are covered with paraffin of different thicknesses. The use of the meaningful orthonormal expansion methods is possible even when sensitivities of only moderate precision are used. The orthonormal sets of functions are constructed from the expected spectra as well as from the sensitivities of the detectors. The calculations, using a digital computer, show that the method employing the expected spectra is useful, particularly when the number of detectors is small. (auth)

**43693** APPLICATION OF DIFFERENT ORTHONORMAL EXPANSION METHODS TO NEUTRON MEASUREMENTS. II. ESTIMATION OF DOSE EQUIVALENT RATES. Ryufuku, Hiroshi (Japan Atomic Energy Research Inst., Tokyo). Jap. J. Appl. Phys., 5: 910-13(Oct. 1966).

The multi-detector method for obtaining neutron dose equivalent rates is discussed in detail by the use of the theory of orthonormal expansion. An examination of two different procedures in which the real or adjoint flux is used shows that the "adjoint flux procedure" is better for neutrons of broad range spectra and also for monoenergetic neutrons. (auth)

**43694** APPLICATION OF DIFFERENT ORTHONORMAL EXPANSION METHODS TO NEUTRON MEASUREMENTS. III. ACTUAL MEASUREMENTS OF SPECTRA AND DOSE EQUIVALENT RATES. Ryufuku, Hiroshi; Tatsuta, Hatsumi; Shirotani, Takashi (Japan Atomic Energy Research Inst., Tokyo). Jap. J. Appl. Phys., 5: 914-17(Oct. 1966).

Neutron spectra and dose equivalent rates were measured with a $BF_3$ proportional counter covered with two, three, or five 0-, 3.5-, 4.5-, 6.5-, 8.5-, and 14.0-cm-thickness paraffin moderators. The dose equivalent rates were also measured with a "Rem-counter" having two detectors, one of which consists of a $BF_3$ counter centered in 30-cm-diameter paraffin cylinder and the other of three $BF_3$ counters embedded at intervals of 120° along a coaxial 16-cm-diameter cylinder in the same paraffin moderator. The obtained dose equivalent rates for neutrons from a RaD-Be source did not differ by more than 22% from the theoretical values given in paper II, even when the measured spectra had large negative values at the same energy. (auth)

**43695** ON DECAY COMPONENT IN $\gamma$ SCINTILLATIONS OF CsI(Tl) CRYSTALS. Berzin, B. Ya. Latv. PSR Zinat. Akad. Vestis, Fiz. Teh. Zinat. Ser., No. 3, 15-18(1966). (In Russian).

A $\gamma$-scintillation component of CsI(Tl) crystals with decay time 8 $\mu$sec at room temperature was investigated. The temperature decrease was found to cause an increase in decay time of that component. It was proved that the activator ions of Tl do not take part in the 8 $\mu$sec $\gamma$ scintillations of CsI(Tl) crystals. (auth)

**43696** FERRO-FERRI-SULFATE METHOD OF $\gamma$-RADIATION DOSIMETRY IN RADIOLOGICAL EXPERIMENT. Vakhlakova, T. V.; Ryabukhin, Yu. S. (Inst. of Medical Radiology, Academy of Medical Sciences, USSR). Med. Radiol., 11: No. 6, 83-5(June 1966). (In Russian).

The ferro-ferrisulfate dosimetry, based on the radio-induced oxidation of $Fe^{2+}$ ions, was examined as to its suitability for radiobiological experiments with $\gamma$ sources. When the time during which the field is nonstationary is negligible, a solution containing a known concentration of $Fe^{3+}$ ions must be used; it was calibrated on the basis of exposure to a $10^4$ to $4 \times 10^4$ rad, determining the actual ferric concentration colorimetrically. The mean square error of this determination amounted to ±4%. If the dose during the nonstationary radiation period cannot be neglected, the limits of the measurement must be extended toward the low-dose range, increasing the sensitivity and the precision of the $Fe^{3+}$ determination. This was achieved by adding benzoic acid to the solution. It was found possible to measure doses from 50 rad on with an error not exceeding ±5%. The solution used for the dosimetry was found to be stable and to yield very reproducible results. (TTT)

**43697** DETERMINATION OF ABSOLUTE ACTIVITIES OF $\beta$ RADIATION FROM SOLUTIONS USING GEIGER-MUELLER COUNTING TUBES. Hoyer, F. (Johann Wolfgang Goethe-Univ., Frankfurt am Main). Nucl. Instrum. Methods, 44: 273-6(1966). (In German).

A simple method is proposed to determine $\beta$-activities by measurement from solution with a Geiger-Müller-endwindow counter. Absolute activities in the energy range 0.4 to 2.5 Mev are easily found by comparison with one single standard activity after fixing up a calibration line by measurement of the relative counting rates of $^{90}$Sr and $^{90}$Y in respect to the counting rate of the radioactive equilibrium. The results are compared with standard preparations of various distributors. (auth)

**43698** SYMMETRY DEFECTS IN POLARIZATION MEASUREMENTS. II. INFLUENCE OF INSTRUMENTATION SYMMETRY DEFECTS ON USUAL METHODS FOR MEASURING POLARIZATION. Libert, J. (Institut Interuniversitaire des Sciences Nucleaires, Mons, Belg.). Nucl. Instrum. Methods, 44: 188-98(Oct. 1966). (In French).

The experimental symmetry defects which may exist in a polarization determination setup are reviewed. Their influence on the experimental conditions of the usual methods of measurement is described in connection with a general formulation of an example, the correctness of which in this particular case is so proved. (auth)

**43699** SYMMETRY DEFECTS IN POLARIZATION MEASUREMENTS. III. DISCUSSION OF THE INFLUENCE OF INSTRUMENTATION SYMMETRY DEFECTS ON USUAL METHODS FOR MEASURING POLARIZATION. Libert, J. (Institut Interuniversitaire des Sciences Nucleaires, Mons, Belg.). Nucl. Instrum. Methods, 44: 199-207(Oct. 1966). (In French).

The polarization value obtained from the usual methods of measurement does not depend on the possible existence of symmetry defects if previously established conditions are fulfilled by the factors expressing the influence of these symmetry defects in a general way. By introducing in the general conditions the particular form assumed by these factors when the symmetry defects are experimental ones, it is possible to state precisely the experimental symmetry defects, the influence of which is avoided completely or not, rigorously or provided that some approximations are valid. As a conclusion, one may say that the usual methods of measurement are nearly equivalent. (auth)

**43700** MULTIPLE SCATTERING OF FAST NEUTRONS IN $^{10}$B-GLASS SCINTILLATORS. Zetterstroem, H.-O.; Stroemberg, L. G.; Schwarz, S. (Research Inst. of National Defence, Stockholm). Nucl. Instrum. Methods, 44: 208-12(Oct. 1966).

Multiple scattering of kev-neutrons in $^{10}$B-loaded glass scintillators was studied by Monte Carlo methods. Three different glass compositions are considered. Systematic trends in the scattering correction are discussed. Results are presented for the neutron energy range $1 < E_n < 500$ kev. (auth)

**43701** CALCULATED GAMMA RAY RESPONSE CHARACTERISTICS OF SEMICONDUCTOR DETECTORS. Wainio, K. M.; Knoll, G. F. (Univ. of Michigan, Ann Arbor). Nucl. Instrum. Methods, 44: 213-23(Oct. 1966).

A Monte Carlo computer program was used to calculate characteristics of the response of fully depleted silicon and germanium radiation detectors to monoenergetic gamma rays. Data for total absorption probability, intrinsic efficiency, escape peak efficiency and pulse height spectra are presented as functions of detector thickness and photon energy. Other parameters of interest in analyzing detector response are also given. The results of a second Monte Carlo calculation of electron migration in silicon and germanium are employed to account for the leakage of secondary electrons from the detector volume. Bremsstrahlung energy loss by electrons is also simulated. The calculations are expected to be applicable in those cases in which secondary electron energies do not exceed 2 Mev. Comparison with experiment shows good agreement within this limitation. (auth)

**43702** MEASUREMENT AND ANALYSIS OF HIGH ENERGY GAMMA-RAY SPECTRA. Whitehead, R. R.; Shute, G. G.; Parker, A. W. (Univ. of Melbourne). Nucl. Instrum. Methods, 44: 229-38(Oct. 1966).

A procedure for the semi-automatic analysis of large numbers of high energy gamma-ray spectra is described. The method of nonlinear least squares is used and the relevant theory is derived with emphasis on the validity of the least squares error estimates in nonlinear problems. The conditions under which the procedure works reliably are given. Experimental requirements imposed by these conditions are discussed and apparatus capable of meeting them is described briefly. (auth)

**43703** CHARGE COLLECTION TIME OF LITHIUM-COMPENSATED SILICON RADIATION DETECTORS. Kuchly, J. M.; Siffert, P.; Coche, A. (Centre de Recherches Nucleaires, Strasbourg). Nucl. Instrum. Methods, 44: 239-44(Oct. 1966). (In French).

The charge collection time in silicon n-i-p detectors, with depletion layers between 100 $\mu$m and 11 mm, was investigated using protons and $\alpha$-particles with energies up to 6 Mev. The results are compared with calculated values and the agreement is found to be good if the detector thickness is less than 3 mm. With thicker diodes and low electric fields, the difference between observed and calculated values is attributed to trapping effects. The influence of several parameters (polarization, ratio of the depletion layer width to the range of the impinging particles, temperature variation between 300 and 80°K) is analyzed. For field strengths between 12 and 38 kv/cm, the transient time and consequently, the drift velocity are constant; the mobility is therefore inversely proportional to the field strength. (auth)

**43704** RELATIONSHIPS BETWEEN LIGHT OUTPUT AND ENERGY RESOLUTION IN THALLIUM ACTIVATED SODIUM IODIDE CRYSTALS. Hill, R.; Collinson, A. J. L. (Borough Polytechnic, London). Nucl. Instrum. Methods, 44: 245-52(Oct. 1966).

The electron response and energy resolution of twelve crystals of thallium activated sodium iodide were measured. The effect on the electron response and energy resolution of straining crystals, either thermally or by subjection to hydrostatic pressure was also investigated. An empirical relationship is established between the shape of the electron response curve and the magnitude of the gamma energy dependent contribution to resolution. The possible origins of this relationship are discussed. (auth)

**43705** INEFFICIENT CHARGE COLLECTION IN SILICON SURFACE BARRIER DETECTORS. Eisler, P. (Chemical Research Lab., Port Melbourne, Australia). Nucl. Instrum. Methods, 44: 253-60(Oct. 1966).

A theory is developed to predict the charge collection efficiency of silicon surface barrier detectors on the assumption that trapping occurs during the transit of the charge carriers to the collecting electrodes. This mode also takes into account the effect of thermal regeneration of the charges from traps and of the amplifier time constant settings, on the charge collection efficiency. The model is experimentally tested and found wanting. The evidence, however, suggests that the trapping occurs during the plasma state of the ionization column. (auth)

**43706** CHARGE DETERMINATION BY THIN-DOWN TRACK WIDTH MEASUREMENTS. Lim, Y. K. (Univ. of Singapore); Fukui, K. Nucl. Instrum. Methods, 44: 261-7 (Oct. 1966).

Mean track width data for tracks of multiply charged ions in nuclear emulsions in the thin-down region from published works and recent measurements were analyzed and found to be reducible to a relation obtainable from a simple model proposed by Bizzeti and Della Corte. The use of this relation in calibration and charge determination is discussed. (auth)

**43707** MOESSBAUER SPECTROMETER CALIBRATION USING $^{57}$Fe ENRICHED METALLIC IRON. Shechter, H. (Israel Inst. of Tech., Haifa); Ron, M.; Niedzwiedz, S.; Herber, R. H. Nucl. Instrum. Methods, 44: 268-72(Oct. 1966).

The use of $^{57}$Fe enriched metallic iron foils as absorbers to calibrate Mössbauer spectrometers can lead to serious discrepancies in the calculated constants. These discrepancies arise from the fact that small amounts of carbon in the metallic foils give rise to apparent shifts in line positions due to a change in the magnitude of the hyperfine fields acting on the iron nuclei. After proper preparation, enriched iron foils can be used for calibration purposes. A velocity calibration based on data for a low carbon (0.02 wt %) iron foil is internally consistent with published NMR data. An accurate value for the quadrupole splitting in sodium nitroprusside and the isomer shift of this absorber with reference to metallic iron are presented. (auth)

**43708** A SPECTROMETER FOR 14 Mev NEUTRON CAPTURE SPECTROSCOPY. Cvelbar, F.; Hudoklin, A.; Mihailovic, M. V.; Najzer, M.; Ramsak, V. (Nuclear Institute J. Stefan, Ljubljana, Yugoslavia). Nucl. Instrum. Methods, 44: 292-300(Oct. 1966).

A telescopic scintillation pair spectrometer for the measurements of energy spectra of gamma rays from the radiative capture of 14 Mev neutrons is described. The main parts of the spectrometer are: a lead foil as a converter of gamma rays to electron-positron pairs, a 12.5 cm dia × 12.5 cm long plastic scintillator in which the energy of pairs is absorbed and an arrangement of two thin plastic scintillators. Two thin scintillators, together with the appropriate electronics, form a coincidence-anticoincidence shield which appreciably reduces the background due to charged particles created in the main scintillator or coming into the spectrometer from outside. An average ratio of the net effect to the background of about 1 : 1 was achieved for medium weight nuclei like Fe. The meson background in the whole energy range of the spectrometer is reduced to about 0.5 cpm. The energy resolution of the spectrometer is 12.5, 9.5, and 8.0% for gamma rays of 12.1, 16.5, and 20.4 Mev, respectively. An average value of the spectrometer efficiency in this energy region is 0.5%. The spectrum of gamma rays from the capture of 14 Mev neutrons in $^{56}$Fe is shown as an example of the application of the spectrometer. (auth)

**43709** PHOTOMULTIPLIER RESOLVING TIME MEASUREMENTS UTILIZING A LIGHT PULSE GENERATOR. **Porter, D.; McDonald, J.; Stewart, D. T. (Univ. of Glasgow). Nucl. Instrum. Methods, 44: 309-13(Oct. 1966).**

The time resolution of a 56 AVP photomultiplier in a fast coincidence arrangement was investigated utilizing a hydrogen spark light pulse generator. The variation of the full width at half height of the timing spectra, measured as a function of the fractional triggering level for a given light intensity, is in qualitative agreement with recent theories of photomultiplier time dispersion. (auth)

**43710** DEAD TIME AND FATIGUE IN SELF-QUENCHING G-M COUNTERS AT DIFFERENT TEMPERATURES. **Peeva, A.; Guleva, D. (Univ. of Sofia). Nucl. Instrum. Methods, 44: 314-16(Oct. 1966).**

Alteration of the dead time of self-quenching G-M counters is traced with relation to temperature and aging (fatigue of the counter). The experimental results show a dependence which is decreasing up to a certain number of registered pulses. Above that number of counts the dependence becomes gradually an increasing one with a growing rate as the fatigue of the counter increases. An explanation of the established dependence is suggested and some preliminary mathematical interpretations are given. (auth)

**43711** GEOMETRICAL RECONSTRUCTION OF HIGH ENERGY INTERACTIONS IN SPARK CHAMBER MAGNET ARRANGEMENTS. **Fries, D. E. (Stanford Linear Accelerator Center, Stanford, Calif.). Nucl. Instrum. Methods, 44: 317-20(Oct. 1966). (SLAC-PUB-183).**

A geometrical reconstruction procedure is described for track coordinates, taken from spark chambers in a nonuniform magnetic field. By a least-squares method all parameters (momenta, spatial angles and the vertex coordinates) of the observed trajectories are fitted simultaneously, which originate at the same vertex. A test run was performed using simulated high energy events in a nonuniform magnetic field where the interaction vertex was assumed not to be measured. (auth)

**43712** SELF-CONTAINED SYSTEM FOR STABILIZING SCINTILLATION AND SEMICONDUCTOR SPECTROMETERS. **Pakkanen, A.; Stenman, F. (Univ. of Helsinki). Nucl. Instrum. Methods, 44: 321-4(Oct. 1966).**

A self-contained system for stabilizing scintillation and semiconductor spectrometers is described. The system uses as a reference signal the counting rate difference between two window discriminators set on slopes of different sign. Typically, a 3-day inherent stability of better than 0.1% is obtained. The system requires no modifications in the system to be stabilized. (auth)

**43713** DEVICE FOR AUTOMATIC DIGITAL DEAD-TIME CORRECTION OF COUNTING LOSSES OF SINGLE AND COINCIDENCE COUNTING RATES. **Seufert, H. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Instrum. Methods, 44: 335-40(Oct. 1966).**

A device is described, which can be used for automatic correction of dead time without lengthening the measuring time. The digitally determined correction is added simultaneously to the uncorrected counting rate without counting loss by a buffer storage system. In particular, it is possible to correct the coincidence counting rate. The setup of the device is described and results of test measurements are given. (auth)

**43714** OBSERVATION OF X-RAYS FROM SPARK DISCHARGES IN A SPARK CHAMBER. **Frankel, S.; Highland, V.; Sloan, T.; Van Dyck, O.; Wales, W. (Univ. of Pennsylvania, Philadelphia). Nucl. Instrum. Methods, 44: 345-8(Oct. 1966).**

The production of x rays from the spark discharges in a thin walled, helium filled spark chamber was observed. The x-ray flux is sufficiently large with helium at atmospheric pressure to destroy the ability of a neighboring thin plate chamber to support charged particle tracks. (auth)

**43715** DEAD TIME CORRECTION OF PULSE HEIGHT SPECTRA WITH A COMPUTER. **Paatero, P.; Eskola, K. (Univ. of Helsinki). Nucl. Instrum. Methods, 44: 357-8 (Oct. 1966).**

A procedure is presented for determining dead time correction of pulse height spectra arithmetically with a computer. The procedure is straightforward in cases where the dead time for a given analysis cycle is independent of the input pulse rate. (B.G.D.)

**43716** PROGRESS IN REACTOR DETECTORS DESIGN AND CONSTRUCTION CARRIED OUT IN THE YEARS 1963–1965. **Jablonska, Jadwiga; Janikowski, Andrzej; Topa, Jerzy (Inst. of Nuclear Research, Swierk, Poland). Nukleonika, 11: 349-58(1966).**

A significant progress in technology and construction of various reactor detector types was performed in comparison to the status described in Prague in the year 1963. The main advances are: new isolating materials, particularly ceramic-to-metal seals and high alumina ceramic elements, hydrogen filling for boron chambers and new chamber assembling methods. The new detectors designed are the following: neutron sensitive gamma compensated ionization chamber RWKJ-8 mounted in the rigid extension PK-58; uncompensated: boron coated chambers AKJ-4 and high sensitive AKJ-3 (suitable for reactor noise measurements) and uranium coated RJ-300; fission chambers: small size chamber 9R-8, start-up chamber RR-100, neutron beam monitoring chamber RM-70 and threshold thorium coated fission chambers ThR-8, ThR-20, and ThR-60. The construction of the detectors is shown and the technical data are given. Finally the future work is briefly mentioned. (auth)

**43717** SEMICONDUCTOR SYSTEM FOR CHARGED PARTICLES IDENTIFICATION. **Chwaszczewska, Janina (Inst. of Nuclear Research, Swierk, Poland); Freindl, Ludwik; Karcz, Waldemar; Przyborski, Wincenty; Slapa, Mieczyslaw. Nukleonika, 11: 359-67(1966).**

A system consisting of two semiconductor counters of types dE/dx and E was built to separate particles from nuclear reactions. The properties of this system were checked by detection of products of reactions induced by 24.8 Mev alpha particles and 12.4 Mev deuterons on Au, C, and Ca nuclei. (auth)

**43718** FAST NEUTRON SPECTROMETER USING Si SURFACE-BARRIER DETECTORS AND Li$^6$F. **Degtyarev, Yu. G.; Kazarinova, M. I.; Protopopov, V. N. Prib. Tekh. Eksp., No. 2, 37-40(Mar.-Apr. 1966). (In Russian).**

A semiconductor neutron spectrometer was developed whose sensing element is a thin film of $^6$LiF sandwiched between two layers of n-Si. Neutron bombardment of the film yields the splitting reaction $^6\text{Li} + n \rightarrow T + \alpha + Q$, in which the combined energies of the triton T and the $\alpha$-particle equal the neutron kinetic energy plus the reaction energy Q. A section of the sensor is shown. Allowing for the loss caused by the gold foil, a figure of Q = 4.6 Mev is used for thermal neutrons and 4.7 Mev for those above 3 Mev energies. The preamplified pulses from each counter are summed, giving an output of about $E_n + Q$, and this output is connected via an expander to the spectrum analyzer;

with the expander, any desired portion of the energy spectrum can be observed. Amplitude spectra of tritons, $\alpha$-particles, and neutrons were obtained for bombarding energies up to 3.2 Mev. Detected pulse amplitudes vs neutron energies over the test range showed a linear relationship. The spectrometer design is recommended as being reliable and stable. (ATD)

**43719** LOW-NOISE $\beta$-COUNTER USING A SOLID STATE ANTICOINCIDENCE CIRCUIT. Blinov, V. A.; Kuznetsov, M. I. (Radium Inst., Leningrad). Prib. Tekh. Eksp., No. 2, 71-3(Mar.-Apr. 1966). (In Russian).

A compact, light-weight, low-noise $\beta$-counter, built on the basis of the DP-100 decade-counting device, is described. An STS-5 counter, surrounded by a ring of anticoincidence-coupled counters of the same type, serves as the active counter and is placed in a lead housing. During the measurement of the activity of high-energy $\beta$ sources, some of the electrons may pass through the main active counter and then through one of the protective counters, thereby activating the anticoincidence circuit. To prevent this, a plexiglass cylinder, 7–8 mm thick, is placed between the main and protective counters to cut off $\beta$ particles with an energy of up to 2 Mev. Five P16 transistors are used in the anticoincidence circuit. Pulse amplitude of the STS-5 counter reaches 150 v and varies as a function of supply voltage. Pulse duration is 150 $\mu$sec. All diodes used in the anticoincidence circuit are either type D9B or D2E. Stable operation of the circuit is not affected by voltage variations of 7.5 to 10 v. The required current in the absence of a signal is about 1 ma and, when loaded with a frequency of 2–3 kc, about 10 ma. The device, which has a noise of 0.8–1 pulse/min, can be used under fixed conditions as well as under conditions of increased humidity and temperature. (ATD)

**43720** AN AUTOMATIC MAGNETIC FIELD CALIBRATOR FOR ELECTRON PARAMAGNETIC RESONANCE MICROWAVE SPECTROMETERS. Bukin, I. I.; Kosyakov, V. I.; Maksimov, V. L.; Nedovodiev, E. V. (Leningrad Polytechnical Inst.). Prib. Tekh. Eksp., No. 2, 93-5(Mar.-Apr. 1966). (In Russian).

A circuit is given for an instrument which automatically calibrates the magnetic field for electron paramagnetic resonance spectrometers. One of the main advantages of the circuit is that it may be assembled from standard components which are available in chemistry and physics laboratories engaged in electron paramagnetic resonance research. The device is conditionally divided into two functional units: a system for automatically tracking the change in the magnetic field of the spectrometer, and a circuit for generating the field pips. The basic element in the first section is a standard IMI-2 magnetometer. The nuclear resonance signal from the phase detector of the magnetometer is fed to the input of a UE-119 amplifier. The output voltage from the amplifier is the supply for a reversible RD-09 motor with a 1/15.62 speed reducer. The motor shaft is connected through a clutch to the vernier shaft of a capacitor for variation of the oscillator frequency in the IMI-2. During scanning of the magnetic field, an error signal appears at the output of the phase detector in the magnetometer. After amplification, this signal causes the motor to change the oscillator frequency in the magnetometer so that resonance conditions are maintained. The basic element in the field pip generating circuit is a 526U heterodyne wavemeter. The voltage from the oscillator in the IMI-2 is fed to an MVL-3 vacuum-tube millivoltmeter. The amplified voltage then goes to the input of the 526U wavemeter where the oscillator frequency is mixed with the heterodyne frequency. The best signals, which result when the oscillator frequency is a multiple of the heterodyne frequency, are the magnetic field pips. After amplification and detection in a 28IM low-frequency amplifier, these pips are recorded together with the electron paramagnetic resonance spectrum on the microwave spectrometer chart. The intervals between pips may be varied within a range of 30 to 60 oersteds. Fields of 1400–3800 oersteds may be calibrated. The relative error in calibration is $3 \cdot 10^{-4}$ or less. Alignment and operating procedure are described as well as some characteristics of the device. Some possibilities for improvement of the circuit are discussed. (ATD)

**43721** A RESONATOR FOR STUDYING ELECTRON PARAMAGNETIC RESONANCE AT THE 10-CENTIMETER WAVELENGTH. Antipin, A. A. (Kazan State Univ., USSR). Prib. Tekh. Eksp., No. 2, 98-9(Mar.-Apr. 1966). (In Russian).

A resonator is described which may be used for observing electron paramagnetic resonance spectra in crystals at 4.2°K. The device is a cylindrical unit of the reflective type with a shortening capacity which has a high Q in the low-frequency range ($\lambda = 10 - 20$ cm). The wave in the resonator is the $E_{010}$ type. The resonator is 45 mm in diameter and 12 mm high. All parts are made from polished brass. A loop is used for optimum coupling to the coaxial line. The unit has interchangeable covers for operation in frequency ranges of 2.5–2.9 and 2.9–3.4 Gc. The device is tuned by rotation of a teflon flag. The tuning range may be increased by changing the shortening capacity. The specimen is located on a small teflon stand at the antinode of the magnetic field which is rotated around the horizontal axis by a rack and pinion mechanism. Micrometer screws are used for precision tuning and specimen orientation. The entire installation including the Dewar flasks may be placed in the gap of an electromagnet to produce fields of up to 8000 oersteds. (ATD)

**43722** WIDE-RANGE DETECTOR OF LIGHT PULSES. Andryushin, N. F.; Antonov, E. A.; Bulatov, B. P.; Koridalin, V. E.; Strelkov, A. S. (Inst. of Physics, Moscow). Prib. Tekh. Eksp., No. 2, 119-23(Mar.-Apr. 1966). (In Russian).

A wide-range device for detecting intermittent light pulses is described. The basic element of the unit is a photomultiplier with alloyed dynodes. The output voltage pulses are taken from load resistors connected in the dynode circuits and fed to the measurement system. With the proper supply voltage and a slight correction in the voltage distribution between dynodes, there is a difference of an order of magnitude between the sensitivities of two adjacent dynodes. A detector with a linear dynamic range covering four orders of magnitude in the intensity of light pulses was made by taking the signals from four dynodes. Various types of photomultipliers were studied by modulator control of the photocurrent and by exposing the photocathode to short bursts of light. The experimental conditions and procedure are briefly described. The photomultipliers used were the FEU-13, -15, and -16 with alloyed dynodes and the FEU-27 and -31 with antimony-cesium coated dynodes. Both methods were used for studying the miniature FEU-15. Typical dynode output curves for this tube are given. The dynodes have a linear output range of more than 6–8 v with a 5% deviation from linearity. Formulas are given for determining signal magnitude in the linear region of the output curve for a given measurement rank, as well as for finding the sensitivity of any rank. The linearity of the dynode characteristics was studied with a direct-current component through the photomultiplier. It was found that the voltage across the dynode gap decreases as the gap approaches the anode. There is a simultaneous increase in the voltage across the dynode gaps closest to the photocathode since the total voltage across the photomultiplier remains constant. This is due to the initial increase in signal magnitude. A further increase in the anode current reduces the pulse amplitude from the dynode as a result of current limiting in the subsequent dynode gap due to the space charge. Thus there is a reduction in the difference between pulse currents in the preceding and succeeding dynode gaps. The sign of this difference may change when the anode current reaches a high enough value, with a resultant change in the polarity of the signal from the dynode. It is found that the direct current through the photomultiplier should be much less than the divider current for normal operation of the device. (ATD)

**43723** CHARACTERISTICS OF COOLED PHOTOMULTIPLIERS OF FEU-39 AND FEU-46A TYPES. Barenboim, G. M.; Domanskii, A. N.; Solomatin, V. F.

(Cytology Inst., Leningrad). Prib. Tekh. Eksp., No. 2, 129-31(Mar.-Apr. 1966). (In Russian).

Results are given of an investigation of the sensitivity and the dark current of the FEU-39 and FEU-46A nitrogen-cooled photomultipliers having antimony–cesium photocathodes without a conducting substrate. Light from an SVD-120A lamp passed through the quartz light guide and the ZMR-3 monochromator, illuminating the photocathodes. A photocurrent two or three times greater than the dark current at room temperature corresponds to the weak light flux with $5 \times 10^3$ photons/sec. The photocurrent due to a strong light flux was not less than $5 \times 10^{-8}$ amp which, according to the calculation, corresponds to a flux with $5 \times 10^5$ photons/sec. The signal from the weak light flux and the photomultiplier noise were measured by counting the pulses developing across the photomultiplier load. Signals from the strong light flux were measured by the microammeter. The following conclusions were reached: Cooling of photomultipliers limit the range of operating light fluxes. If the recorded light flux is sufficiently weak ($<5 \times 10^3$ photons/sec), the photomultiplier may be cooled to the temperature of liquid nitrogen. Under the action of strong light fluxes ($<5 \times 10^5$ photons/sec), cooling below −80C leads to a sensitivity drop. The sensitivity, which is dependent at the given temperature on the intensity of the light flux, is not immediately restored, which leads to certain limitations in rapid measurements. Optimum cooling temperatures and signal-to-noise ratios for various light fluxes are determined. (ATD)

**43724** SPARK CHAMBERS FOR RECORDING SLOW PARTICLES. Radkevich, I. A.; Tomashchuk, Yu. F.; Smolyankina, T. G.; Sokolovskii, V. V. (Inst. of Theoretical and Experimental Physics, Moscow). Prib. Tekh. Eksp., No. 3, 35-40(May-June 1966). (In Russian).

Frame-type and pen-box-type spark chambers with an interelectrode gap of 1 cm are described; each type may have thin and thick electrodes. A device for aluminum foil stretching is shown (a sketch), as well as a system for gas filling and gas purification. A 12-gap frame-type chamber had memory times of 300 and 550 nsec for clearing fields of 600 and 400 v, respectively; the efficiency corresponding to the minimum delay was 0.97. Plots of chamber efficiency vs pulse delay for various clearing voltages are given. (ATD)

**43725** SPARK CHAMBER WITH ACOUSTIC SPARK LOCATION. Lepekhin, F. G.; Ovchinnikov, B. M. (Inst. of Physics and Tech., Leningrad). Prib. Tekh. Eksp., No. 3, 41-4(May-June 1966). (In Russian).

A new spark chamber in which spark coordinates are a automatically determined by an acoustic-location method is described. A special electrostatic microphone was constructed. An Al-sprayed dacron 8-m thick $4 \times 30$-mm film was used in the microphone; capacitance, 150 pf; maximum frequency, 1 Mc; the input characteristic is linear within a 1:10 signal range. A 5-gap $200 \times 40$-mm electrode chamber had a microphone at each spark gap. The chamber was controlled by two scintillation counters. A transistorized nonoverloading amplifier (principal circuits shown) was used in conjunction with the chamber. The best resolution of the microphone-amplifier system was 4 mm. These chambers can be used for recording several simultaneous events. A special circuit was developed for suppressing noise whose height is $\frac{1}{10}$ of that of the signal and which persists for 50 msec after the signal. (ATD)

**43726** SOFT X-RAY DETECTOR FOR THE 1 TO 12 A RANGE. Ipatkin, I. S.; Bulatov, B. P.; Antonov, E. A. (Earth Physics Inst., Academy of Sciences, USSR). Prib. Tekh. Eksp., No. 3, 66-9(May-June 1966). (In Russian).

A soft x-ray detector is described which was designed to register radiation in the 1–12 Å range. The design comprises the detector proper and an attached x-ray source for calibration. Detection is made by means of an FEU-15 or -16 photomultiplier using a plastic scintillator. The detector is housed in a light-tight casing, except for the input window, which is covered with a thin layer of vaseline. Detected output is taken off an emitter follower for recording, etc. The detector is calibrated differentially by bombarding the scintillator from the controlled x-ray source through a series of beryllium foil filters of various thicknesses. Characteristic curves for the detector are given. Operation can be in a pulsed or continuous mode, and the energy range registered is from 1 to 20 kev. X-ray flux recorded over a given spectral interval is estimated accurate within 15–20%. (ATD)

**43727** PHOTOMULTIPLIER SENSITIVE IN THE ULTRAVIOLET SPECTRAL REGION. Dalinenko, N. K.; Razumovskaya, A. I. Prib. Tekh. Eksp., No. 3, 212-13 (May-June 1966). (In Russian).

The design, basic characteristics and parameters of a photomultiplier sensitive in the ultraviolet region are briefly described. The photomultiplier, bearing the designation FEU-57, is several orders of magnitude more sensitive in the ultraviolet than it is in the visible spectral region. It has a plane frontal window of uv glass and a photocathode with an effective diameter of 44 mm. The photomultiplier (maximum length, 120 mm; diameter, 52 mm) has a tellurium–cesium photocathode. Its spectral characteristics are measured by a dual monochromator beginning at 2200 Å using a hydrogen lamp as the light source. The spectral sensitivity of the photocathode for three FEU-57's in absolute units with quantum yield of 0.5%, 5%, and 9% is given. The photomultiplier has an average gain of about $10^5$ to $10^6$ at a 1700-v operating voltage. The output dark current is within $10^{-9}$–$10^{-11}$ a at the same operating voltage. (ATD)

**43728** NEW DESIGN OF TRANSISTOR RADIATION DETECTORS. Kalisz, Jozef. Przegl. Elektron., 7: 313-23(July 1966). (In Polish).

Design and specifications are given for a transistorized rate meter of the TOM 202 type. (R.V.J.)

**43729** MEASUREMENT OF THE INTEGRAL FLUX OF FAST NEUTRONS BY MEANS OF GEIGER–MUELLER COUNTERS WITH ACTIVABLE CATHODES. Bayle, Pierre (Faculte des Sciences, Toulouse); Rakotondrafara, Henri; Levy, Michel; Vallee, Annie. Rev. Phys. Appl., 1: 97-100(June 1966). (In French).

Geiger-Mueller counters with activable cathodes of aluminum, silver, copper, brass or stainless steel are used for the measurement of integral fluxes of 14 Mev fast neutrons. The measurement of the detector count rate after activation is directly related to the neutrons total flux. The minimum flux measurable is determined by the counter background, the maximum value measurable by its dead time. The minimum detectable dose is 5 m rad with copper cathodes, the maximum dose is 40 rad, for stainless steel cathode counters and low fluxes. (auth)

**43730** SILICON DIODES USED IN NEUTRON DIFFRACTION. Gilly, L.; Robert, A.; Roult, G. (CEN, Grenoble, France). Rev. Phys. Appl., 1: 149-52(June 1966). (In French).

Surface barrier detectors have been used in neutron diffraction: for optimum setting of the monochromator crystal and for drawing a monochromatic beam map, and as a counting monitor. A microdiode, which was located in several points of the channel used at the Siloe reactor, and a bigger diameter diode, which was mounted in a special container in the monochromatic beam, are discussed. (auth)

**43731** DISCRIMINATION OF NUCLEAR TRACKS IN IONOGRAPHIC EMULSION BY ELECTRON MICROSCOPY. Bilwes, L. (Centre Nucleaire, Strasbourg); Cueer, P.; Nicolae, M.; Schmitt, R. Rev. Roum. Phys., 11: 377-83 (1966). (In French).

A method of preparation, development, and electron microscopic observation of thin layers of ionographic emulsion was developed to be used for the discrimination of ionizing particles in cases where optical microscopy is not suitable. The electron microscopic observation of tracks developed in fine and compact grains permits a very good resolution by showing the structure of the tracks. The results of this study indicated the possibility of using this method for a good discrimination of heavy ions and of measuring the ionization by counting grains in cases where usual methods are not sufficient. (tr-auth)

**43732** VERSATILE HIGH PRESSURE MOESSBAUER APPARATUS. **Debrunner, P.; Vaughan, R. W.; Champion, A. R.; Cohen, J.; Moyzis, J.; Drickamer, H. G. (Univ. of Illinois, Urbana). Rev. Sci. Instrum., 37: 1310-15(Oct. 1966). (COO-1198-365).**

An apparatus was developed which permits high pressure Mössbauer resonance studies to 300 kbar. It can be operated with either the source or the absorber under pressure. The pressures are established by x-ray diffraction measurements, and calibration curves are presented for both the supported taper and Bridgman anvils cells. A motion device involving magnets and phosphor bronze springs, with an adjustable mount, is described. Circuits necessary to control the motion, and to distribute the signals from two devices operating in parallel, are outlined. (auth)

**43733** HIGH PRESSURE $^3$He GAS SCINTILLATION NEUTRON DETECTOR. **Aamodt, R. Lee; Brown, Leon J.; Smith, Gordon M. (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instrum., 37: 1338-40(Oct. 1966).**

Construction details are given for a He gas scintillation neutron detector which operates to 238 atm at room temperature. A bakeable pressure-vacuum manifold, on which the detector is evacuated and filled, also serves to remove contaminants from the DPS waveshifter. The detector appears stable when permanently sealed off. Curves are given for light output vs pressure, and some effects of impurities on such curves are noted. Measurements were made of relative sensitivity to $^{60}$Co gammas and Pu–Be neutrons. The gamma flux required to induce a current equal to that from 1 neutron/cm$^2$ sec is 15 Mev/cm$^2$ sec when the scintillating gas is $^4$He, and 23 Mev/cm$^2$ sec when it is $^3$He. (auth)

**43734** SPARK CHAMBER FOR GAMMA-RAY ASTRONOMY. **Frye, G. M. Jr.; Smith, L. H.; Hruschka, A. A.; Goff, J. R.; Zych, A. D. (Case Inst. of Tech., Cleveland). Rev. Sci. Instrum., 37: 1340-4(Oct. 1966). (COO-818-80).**

A spark chamber system is described which is designed to detect $\gamma$ rays in the cosmic radiation on high altitude balloon flights. It has an acceptance cone of 30° half angle; time resolution of 150 msec; energy resolution from 30 to 500 Mev; and for a 100 Mev $\gamma$ ray, a conversion efficiency of 12.4%, and angular resolution of 3°. Events are recorded photographically. The system is triggered by a large scintillator above the chamber in anticoincidence with a scintillator-Cherenkov telescope beneath. Only the chamber and high voltage components are pressurized. A magnetometer direction monitor locates the $\gamma$ ray direction to ±3° in right ascension and declination. The system has operated successfully on day and night flights and has a total weight of 80 kg. (auth)

**43735** LARGE APERTURE, HIGH EFFICIENCY ION DETECTOR. **Gibbs, Hyatt M.; Commins, Eugene D. (Univ. of California, Berkeley). Rev. Sci. Instrum., 37: 1385-90(Oct. 1966). (UCRL-16714).**

A simple, highly efficient detector was developed for negative ions that is similar to B. W. Ridley's for positive ions. The negative ions are accelerated to 10 kev, strike a Duralumin surface at 45° incident angle, and eject secondary electrons. These are in turn accelerated by 10 kev and focused crudely onto a plastic scintillator joined to an RCA 8575 photomultiplier tube. The detector has an entrance aperture of 5 × 5 cm, over which the sensitivity is uniform. The Duralumin surface requires no special preparation other than perfunctory initial cleaning, and the detector functions with excellent stability even in a rather poor vacuum ($\approx 10^{-5}$ torr). With appropriate voltage changes in the ion source the detector was tested successfully for most of the positive alkali ions as well as the negative halogen ions F$^-$, Cl$^-$, Br$^-$, and I$^-$. The detector noise is a few counts per second at efficiencies exceeding 90% for all these ions, excluding grid losses. (auth)

**43736** HIGH GAIN SATURATION EFFECTS IN PROPORTIONAL COUNTERS. **Culhane, J. L.; Sanford, P. W. (Univ. College, London). Rev. Sci. Instrum., 37: 1424-5(Oct. 1966).**

The linearity of energy response in a pair of proportional counters was measured. The counters were filled to a pressure of 1 atm with a 90% argon and 10% methane gas mixture. (B.G.D.)

**43737** SEMICONDUCTOR REVOLUTION IN NUCLEAR RADIATION COUNTING. **Hollander, J. M.; Perlman, I. (Univ. of California, Berkeley). Science, 154: 84-93 (Oct. 7, 1966).**

Some applications of gamma-ray spectroscopy using semiconductor materials are discussed. Accomplishments in the areas of semiconductor spectrometers, auxiliary aspects of nuclear spectroscopy, radiochemical tracing and analysis, and particle spectroscopy are reviewed. (J.H.M.)

**43738** DETECTION OF RELATIVISTIC PARTICLES. **Yuan, Luke C. L. (Brookhaven National Lab., Upton, N. Y.). Science, 154: 124-30(Oct. 7, 1966).**

A review is given of detectors that are capable of identifying and detecting particles in the relativistic region. Cloud and bubble chambers, spark chambers, Cherenkov counters, Cherenkov chambers, and relativistic-rise detectors are discussed. Applications of existing detection techniques are possible up to an energy region of several hundred Bev. Existing detectors are limited for general applications in the identification of particles in the ultra-relativistic region. Detectors making use of the relativistic rise effect seem to show considerable promise. (J.H.M.)

**43739** NUCLEAR RADIATION DETECTORS BASED ON SEMICONDUCTOR DEVICES. PART IV. ASSOCIATED ELECTRONICS SYSTEMS OF SEMICONDUCTOR DETECTORS. **Poenaru, D. N.; Vilcov, N. (Inst. for Atomic Physics, Bucharest). Stud. Cercet. Fiz., 18: 655-702(1966). (In Rumanian).**

In order to enable the detector to yield valid information about the flux characteristics of the detected particles, the signals must be handled by an associated semiconductor electronic system. In view of their excellent energy and time resolution, these systems are widely used to replace the older types of detectors. The chief advantage presented by the semiconductors in such applications lies in the low energy dissipation; e.g., detection of 100-kev monoenergetic particles results in a standard deviation of 0.6, 1.6, and 8.5 to 10%, if semiconductor, ionization chamber, and scintillation detectors, respectively, are used. Specific problems of electric charge pulse-voltage pulse conversion, and those caused by the preamplifier noise are reviewed. The semiconductor detector spectrometer contains also a main amplifier, determining the maximum signal/noise ratio, an expander and an amplitude analyzer; the latter is mostly of the multichannel type. The application of the bipolar transistors is also reviewed. (Review article, total of 186 references in 4 parts). (TTT)

**43740** OPERATIONAL PROGRAM FOR V$^0$ EVENTS RECORDED IN A WILSON CHAMBER. **Neagu, D. V. (Inst. for Atomic Physics, Bucharest). Stud. Cercet. Fiz., 18: 703-50(1966). (In Rumanian).**

Great improvements have been made in chambers used to render visual the tracks of elementary particles, such as the cloud, bubble, scintillation, spark, or discharge chambers. Thousands of pictures, are obtained in a single work session; as all of the pictures may contain a record of the desired event, all of them must be systematically inspected. This operation may be divided into several stages: scanning, or rapid,—mostly visual, inspection of the photographs, resulting in the preliminary selection on the basis of general, qualitative criteria, measurement of the selected events by determining angles, distances, curvatures and the degree of darkening of the film, or counting the number of bubbles alongside of the track, calculation of the parameters possessing a physical meaning by means of a mathematical algorithm. In addition, dynamic parameters, such as impulse, energy or ionization loss and multiple scattering of each track must be also taken into account. These stages are closely interrelated and the work may be carried out in an overlapping manner. In order to increase the efficiency, the study must be organized as a system of unit processes. The actual program used in the handling of photographs obtained in a study of $K_2^0$ mesons was outlined, together with the computer program used for the reconstruction of the spatial configuration. (TTT)

**43741** USING OF SEMICONDUCTORS ALL COUNTERS OF TYPE p-I-n FOR STUDY OF NUCLEAR REACTIONS. Vavilov, V. S.; Golovina, N. V.; Iferov, G. A.; Tulinov, A. F.; Chukichev, M. V. Vestn. Moskov. Univ., Ser. III, Fiz. Astron., No. 1, 81-4(Jan.-Feb. 1966). (In Russian).

Semiconductor charged-particle detectors with p-i-n junctions were prepared on the basis of lithium ion drift in silicon. The counters were used in the investigation of nuclear reactions of $\alpha$-particles accelerated in a 26-Mev cyclotron. Diagrams of differential cross sections and angular distributions from elastic and inelastic scattering of $\alpha$ particles in $^{12}C(\alpha,\alpha)^{12}C$ are given. (R.V.J.)

**43742** DETERMINATION OF DEPTH OF BARRIER WINDOW IN N-I-P STRUCTURE. Mikhaleva, T. N.; Mednikov, A. K.; Stroikin, N. I.; Chuprunov, D. L. Vestn. Mokov. Univ., Ser. III, Fiz. Astron., No. 1, 120-1(Jan.-Feb. 1966). (In Russian).

A method is suggested for measuring the barrier (the lithium saturated layer) without any technological change in the n-i-p Si detector. An amplitude analyzer was used for measuring the shift of conversion lines with the change in the direction of detector irradiation and the track-range curve in the silicon. Measurements of protons and $\alpha$ particles accelerated in a 120 cm cyclotron were tabulated. Measurements of $\alpha$ particles scattered on a thin Au target at 60° and recorded with n-i-p Si detector, with 1000 ohm cm specific resistance and ~1 cm$^2$ working area and ~1.3 mm depth sensitivity were in good agreement with the data on the depth of barrier during $\alpha$ particle and proton measurement. (R.V.J.)

**43743** DETECTION OF ELECTRON AVALANCHES WITH ELECTROSTATIC CHARGE IMAGES ON INSULATED FOILS. Grosskreutz, R. (Univ., Hamburg). Z. Angew. Phys., 21: 200-2(1966). (In German).

The electrons of electron avalanches are collected on thin insulating foils (20-40$\mu$m) attached to the anode of a parallel plate discharge gap. These accumulations of charges are developed into visible images by conventional xerographic techniques. An arrangement suitable for obtaining charge images is described. Results are presented for various insulating foils and developing techniques. Electron avalanches containing some $10^7$ electrons and with an avalanche head diameter of about 1 mm can easily be made visible. (Such avalanches are obtained for example in 100 Torr $CO_2$, $E/p = 62$ V/cm · Torr, $d = 0.5$ cm.) In addition, a simple method is described of recording the tracks of alpha particles in gases by means of electron avalanches and charge image techniques. (auth)

**43744** MOLIERE'S THEORY OF MULTIPLE SCATTERING APPLIED TO THE SPARK CHAMBER. Pinkau, Klaus (Max-Planck-Institut fuer Physik und Astrophysik, Munich. Institut fuer Extraterrestrische Physik, Garching, Ger.). Z. Phys., 196: 163-73(1966).

Multiple scattering measurements in the spark chamber require a theory that takes account of the inhomogeneous structure of such a chamber consisting of plates and gaps. Such a theory is developed here. The distribution of the second differences of the lateral separation of the sparks from a straight line is given, also its mean value is calculated. The radial and angular distribution functions for arbitrary distances in the chamber are derived. (auth)

**43745** THE NEUTRON DECAY SPECTROMETER: A NEW TOOL FOR NEUTRON SPECTROMETRY AND CROSS-SECTION MEASUREMENTS. Parkinson, T. F.; Woods, J. J.; Yang, T. (Univ. of Florida, Gainesville). 17p. (CONF-660303-42). ORAU. Gmelin, AED-CONF-66-034-11.

From American Physical Society, Conference of Neutron Cross Section Technology, Washington, D. C.

The neutron-decay spectrometer (NDS) depends on the spectral analysis of the proton and beta particles that originate from neutron decay. Preliminary work demonstrated the feasibility of the method. The resolution of the NDS was investigated using epithermal neutrons generated by the Be(p,n) and Li(p,n), reactions. For improved resolution, coincidence counting techniques were employed using a neutron beam from a reactor. (auth)

**43746** FAST COUNTING WITH THE SCINTILLATION DETECTOR. Young, W. A. P.; Ridley, R. G.; Daly, N. R. (Atomic Weapons Research Establishment, Aldermaston, Eng.). 5p. (CONF-650519-11). ORAU. Gmelin, AED-CONF-65-120-44.

From 13th Annual Conference of American Society of Testing Materials, St. Louis.

Experience with the 56 AVP Mullard and 9594 E.M.I. photomultipliers is described. Harwell 2000 series amplifiers and scalers giving a 10 nsec double pulse resolution were used. Problems associated with ion counting with the scintillation detector at count rates above $3 \times 10^6$ counts/sec are discussed. (auth)

**43747** USE OF LITHIUM FLUORIDE DOSIMETERS FOR IN VIVO MEASUREMENT OF TRANSMISSION THROUGH BONE AND LUNG. Crosby, E. H.; Boone, M. L. M.; Almond, P. R.; Worsnop, B. R.; McGoodwin, M. C.; Shalek, R. J. (Univ. of Texas, Houston). 24p. (CONF-650637-11). ORAU. Gmelin, AED-CONF-65-151-22.

From International Conference on Luminescent Dosimetry, Palo Alto, Calif.

The physical characteristics of LiF dosimeters were studied. Under optimum conditions (irradiation with $^{137}Cs$ $\gamma$ rays) the reproducibility of response was ±1%. For normal laboratory exposures in the range 50 to 300 rads the reproducibility was ±2%. In clinical applications it varied from ±2 to ±5%. A study of the decay of thermoluminescence after irradiation showed an initial decay of about 10% during the first 24 hours and then a steady decay of a further 4% in 50 days. A marked decrease in response of about 10% as compared to $^{60}Co$ $\gamma$ rays was noticed at high energies using 6 to 18 Mev electrons and 22 Mevp x rays. The dosimeters were used for a series of dose intercomparisons between different laboratories. Agreement between preirradiated controls that stayed in Houston and those that went to the other institutions was ≤1%. The effects on depth dose of nontissue-equivalent materials such as bone and lung were studied by in vivo measurements in dogs and patients for high energy electron beams. These measurements utilized esophageal, intrabronchial, and intra-oral dosimeters, and dosimeters within internally located surgical defects. (auth)

**43748** LIQUID SCINTILLATION SPECTROMETER DETECTION CHAMBER AND REMOVABLE TRAY FOR SUPPORTING A PLURALITY OF SAMPLE CONTAINERS. Long, Michael J.; Dawson, John W.; Soderquist, Charles E. (to Vanguard Instrument Corp.). U. S. Patent 3,270,202. Aug. 30, 1966. Filed Apr. 16, 1963.

A liquid scintillation spectrometer adapted for the identification and evaluation of radioactivity in substances contained in a liquid scintillation medium is described. About 100 samples laced with a liquid scintillation medium are located in a tray in a console cabinet. An indexing device is used to present the samples to a photodetector. Power for the indexing drive is provided by a small electric motor. An elevator lifts each sample to the detector and returns it to the tray. (F.S.)

**43749** DATA HANDLING AND CONTROL CIRCUIT FOR LIQUID SCINTILLATION SPECTROMETERS. Dawson, John W.; Long, Michael J. (to Vanguard Instrument Corp.). U. S. Patent 3,271,574. Sept. 6, 1966. Filed Apr. 16, 1963.

A circuit is described that controls and synchronizes the operation of motor-controlled sample handling instrumentation, scintillation detection circuitry, and data presentation devices in a liquid scintillation spectrometer. The spectrometer control circuit, including detection circuitry, yields signals corresponding to sample characteristics, and at the same time eliminates undesirable background signals. Another circuit is provided for checking the reliability of data storage and readout circuits. (F.S.)

**43750** PORTABLE MULTIPURPOSE RADIATION MONITOR (Engineering Materials). (Savannah River Operations Office (AEC), Aiken, S. C.). (CAPE–1478). 14 drawings.

A basic electronic package was developed to be used with various radiation detectors. The package consists of transistorized plug-in circuits powered by rechargeable NiCd batteries, a readout meter, and an electromechanical register, packaged in a 3 × 5 × 6 in. case. Also included are drawings describing alpha and neutron survey meters. The alpha meter uses a $4\frac{1}{2}$ in. diameter × $\frac{1}{32}$ in. thick Lucite scintillator coated with ZnS(Ag) and coupled to a photomultiplier tube. The neutron meter employs a moderating polyethylene cylinder containing a cone-shaped Lucite light pipe in contact with a photomultiplier tube. The slanting surface of the cone is coated on one side with ZnS(Ag). The alpha detector efficiency is 12% with complete insensitivity to gamma radiation up to ~5 R/hr. With an electronic discrimination setting to allow only 10–20 c/m in a 5 R/hr gamma field, fast neutron response in ~ 4c/m/mR/hr. (For details See TID-4100 Suppl. 37) (F.S.)

**43751** FILTER MEANS FOR USE IN MEASURING THE RADIOACTIVITY OF AEROSOLS. Althuser, Meinrad (to Landis and Gyr AG). U. S. Patent 3,261,149. July 19, 1966. Filed Sept. 10, 1962.

An endless, flexible, perforated conveyor belt system used in air monitoring is described. Air is drawn through filter paper carried by the conveyor belt. Radioactivity from the aerosols is deposited on the filter paper and the conveyor carries the filter paper to any conventional detection apparatus to be monitored for radioactivity. (F.S.)

## Radiation Effects

*Refer also to abstract 45009.*

**43752** (AD–635583) SURFACE EFFECTS OF RADIATION ON MICROELECTRONIC DEVICES. PART II. Final Report. Binder, D.; Kuehne, B. M.; Steele, D. A. (Hughes Aircraft Co., Fullerton, Calif.). Apr. 15, 1966. Contract N228(62479)68466. 90p. (USNRDL-TRC–44; FR–66-17-186). CFSTI $3.00 cy, $0.75 mn.

Both intermediate and semipermanent effects of ionizing radiation were studied for three types of metal-oxide-silicon field effect transistors (MOSFET's): the n-channel 2N4038 (enhancement), the p-channel 2N3638 (enhancement) and an n-channel silicon-on-sapphire thin film (depletion) device. Intermediate effects were studied by the observation of conductivity changes as a function of successive irradiations at various bias points. Both conductivity changes and changes in transconductance were observed in the study of semipermanent effects resulting from each irradiation. One-half the number of samples of each type were irradiated with high energy electrons, the remaining samples with equivalent dose $^{60}$Co gamma rays. Very significant intermediate and long term effects were exhibited by all devices studied. Radiation-induced conductivity changes for electron and $^{60}$Co irradiation were in factor of two to three agreement. The results of irradiation, for total observed doses up to $10^5$ rads, increase in the concentration of negative charge in the conducting channel region for both n- and p-channel units. In n-channel units, irradiation generally caused an increase in drain current at a given operating point, and a lowering of the gate threshold voltage for enhancement devices. In p-channel units, irradiation generally caused a decrease in drain current at a given operating point, and a corresponding raising of the gate threshold voltage. Changes in the gate threshold voltage are most significant, since this parameter affects the channel conductivity for all device operating points. Two models are discussed for the observed effects: (a) modification of the charge associated with defect centers immediately at the oxide-silicon interface, located in the channel, and (b) space charge modifications in the channel due to a build-up of positive ions in the adjacent oxide layer. Recovery of the irradiated devices was also studied. N-channel units showed a significantly greater tendency toward recovery than did p-channel units, both at room temperature and in response to heat treatment at 150°C. Semipermanent effects in n-channel thin film MOSFET's were similar to those observed for the bulk n-channel units. However, intermediate effects indicated the presence of a competing short term effect which is explained in terms of the thin film geometry. The results for the various types of devices tested were compared to determine their relative vulnerability to radiation-induced surface effects. In general, p-channel MOSFET's were found to be more vulnerable to radiation-induced surface effects than n-channel units. (auth)

**43753** (AD–636773) RADIATION EFFECTS ON (MONOLITHIC) MICROELECTRONIC CIRCUITS. Quarterly Report No. 4, February 1, 1966–April 30, 1966. Perkins, C. W.; Marshall, R. W.; Liebschutz, A. M. (Hughes Aircraft Co., Fullerton, Calif.). July 1966. Contract DA-28-043-AMC-01313(E). 24p. (ECOM–01313-4). CFSTI $1.00 cy, $0.50 mn.

This program is intended to provide an understanding of the effects of nuclear weapon radiation environments on military electronic systems using microelectronic circuitry of the monolithic silicon integrated type and, thus to furnish engineering guidelines by which these systems may be hardened to these effects. Preliminary results of the remedial action tests on transient radiation effects show no effect in varying the circuit topology or isolation region configuration, except in the air-ionization leakage effect, which is about 20 percent of the total effect. Gold doping raises the critical radiation thresholds by at most an order of magnitude in going from a concentration of 0 to $3 \times 10^{16}$ atoms/cc. Base-width variations have no effect. Thin-film resistors show a considerably smaller response than do diffused resistors. This could be important in those DTL ON gates which show a response presumably due to base circuit effects including possible effects in the base circuit resistors. Permanent damage in monolithic digital circuits is entirely predictable on the basis of known damage effects in transistors. Theoretical expressions for critical radiation thresholds are derived and yield numerical values in excellent agreement with measured values. Since these values fall well above the desired minimum of $10^{13}$ nvt for all circuits, no remedial action for permanent damage is required under this program. (auth)

**43754** (EGG–1183-2046) INCREASED TRANSISTOR RELIABILITY IN NUCLEAR ENVIRONMENTS. Technical Report S-297-R. Azary, Z. (Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). Oct. 1965. Contract AT(29-1)-1183. 195p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

An investigation was made to determine the feasibility of a technique capable of providing increased transistor reliability in a nuclear environment. This technique is based on the preapplication neutron-irradiation of transistors to an exposure level just beyond a selected chosen damage threshold. The results of the investigation show that the technique is capable of identifying specific units that would be likely to fail catastrophically or which would exhibit excessive gain degradation if they were placed in active service. It is shown that gain degradation for certain types can be predicted within relatively narrow limits, using a simple mathematical model. For other types of transistors, where the mathematical model is inadequate for predicting degradation of individual units, statistical analysis was employed. This analysis shows that the relative spread in transistor gains after a large exposure to neutrons, with the exception of the units that failed, is approximately the same as that after a small preapplication exposure. (auth)

**43755** (SC-DC-66-1821) ANOMALOUS PHOTOCURRENT GENERATION IN TRANSISTOR STRUCTURES. Habing, D. H.; Wirth, J. L. (Sandia Corp., Albuquerque, N. Mex.). July 1966. Contract AT(29-1)-789. 25p. (CONF-660705-2(Rev.)). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From IEEE Annual Conference, Palo Alto, Calif.

This report supersedes SC-DC-66-1415.

It was previously reported that, at relatively modest dose-rates ($\sim 10^9$ R/sec), certain transistor types exhibit an anomalous primary photocurrent response which results in serious departures from the commonly assumed linear dose-rate dependence. Additional experimental evidence concerning the anomalous photocurrent problem and a model which explains the observed data in terms of carrier generation and transport processes within the device are presented. The analysis and supporting experimental evidence shows that the observed phenomenon is the result of base-emitter junction breakdown. This breakdown is induced by transverse photocurrent flow in the active base region and causes the device to assume a common emitter configuration wherein the primary photocurrent is amplified by the device gain. (auth)

**43756** EFFECT OF PULSED X RAYS ON A $BF_3$ COUNTER. **Fukuda, Kyue; Okabe, Shigeru; Nakamura, Sigeki. Ann. Rep. Radiat. Center Osaka Prefect., 6: 68-70(1965).**

A shift of differential amplitude distribution of a $BF_3$ counter, which was due to the effect of intensive pulsed x rays, was found during the study of photoneutron reaction. It was investigated using pulsed x rays of different intensities as a function of delay time from the x ray burst. A measurement was also made for the case of continuous gamma-ray background. (auth)

# ISOTOPE TECHNOLOGY

## General

**43757** (ORNL-TM-1505(Pt.2)) SELECTED ABSTRACTS OF NON-U.S. LITERATURE ON PRODUCTION AND INDUSTRIAL USES OF RADIOISOTOPES. From NSA, April–June 1966. Gerrard, Martha; Baker, P. S.; Lafferty, Robert H. Jr. (Oak Ridge National Lab., Tenn.). Oct. 1966. Contract W-7405-eng-26. 38p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

More than 250 abstracts of non-U. S. publications on production and use of radioisotopes and radiation, selected from the April–June 1966 issues of Nuclear Science Abstracts, are presented. (auth)

**43758** ISOTOPES AND RADIATION TECHNOLOGY. Volume 3, Number 4. Baker, P. S.; Lafferty, Robert H. Jr.; Gerrard, Martha; Fuccillo, D. A.; Greene, R. E.; McKinney, F. E.; Carden, Joan E.; Rupp, A. F. (eds.). Contract W-7405-eng-26. One of the five Quarterly Technical Progress Reviews published for the Division of Technical Information, USAEC. Oak Ridge National Lab., Tenn., Summer 1966. 402p. GPO $0.70 Domestic, $0.90 Foreign.

Research is reported on industrial uses of particle accelerators, isotope production and development, isotope technology development, food irradiation, applications in medicine, and isotope utilization around the world. Separate abstracts were prepared for 11 sections of the review. (M.C.G.)

*For abstracts of individual sections see: 42723, 43118, 43119, 43765–43769, 43801, 43802, and 44051.*

## Industrial Applications

*Refer also to abstracts 42727 and 42815.*

**43759** (AECL–2298(Vol.4)) GAMMA IRRADIATION IN CANADA. (Atomic Energy of Canada Ltd., Ottawa (Ontario). Commercial Products Div.). Nov. 1965. 128p. Dep. mn. AECL $1.00.

Eleven papers are included; separate abstracts have been prepared for three. Eight papers were previously abstracted for NSA; see 17: 20071 and 31808; 18: 12200, 31589, and 33993; and 19: 7067, 9562, and 28372. (R.C.K.)

*For abstracts of individual papers see: 43763, 43770, and 43773.*

**43760** (STI-DOC-10/54) APPLICATION OF FOOD IRRADIATION IN DEVELOPING COUNTRIES. Technical Reports Series No. 54. Report of a Panel Held in Vienna, August 3-6, 1964. (International Atomic Energy Agency, Vienna (Austria)). 1966. 193p. IAEA: $4.00; S84,-; £ 1.4.0; FFr 16,-; DM 14.

Separate abstracts were prepared on 16 papers included in this report. (C.H.)

*For abstracts of individual papers see: 42727, 42954, and 43774–43787.*

**43761** THE USE OF NUCLEAR RADIATION FOR AUTOMATICALLY CONTROLLING THE LEVEL OF THE LIQUID METAL IN A CRYSTALLIZER WHEN STEEL IS CAST BY THE CONTINUOUS PROCESS. Hou, Hua-sheng; Kuo, Wu-ming; Wang, Chuan; Chao, Ching-an; Yang, Chiang-sheng. Ching Hua Ta Hsueh Hsueh Pao, 12: No. 2, 1-6 (June 1965). (In Chinese).

A radiometric system for regulating the level of molten metal in a continuous steel casting process is described. Application of the system resulted in a 25% increase in output. (TSS)

**43762** UTILIZATION OF RADIOACTIVE ISOTOPES IN CONSTRUCTION PROBLEMS. II. MEASUREMENT OF SOIL DENSITIES AND LOCATION AND MEASUREMENT OF IRON ARMATURES IN CONCRETE. Del Val Cob, M.; Plata Bedmar, A. (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid), 10: 115-24(Mar.-Apr. 1966). (In Spanish).

The measurement of soil density by radioactive methods is based on the absorption or re-dispersion of $\gamma$ rays emitted by a radioactive source. The various experimental devices that can be used are described. The location and measurement of the thickness of iron armatures in concrete is of interest for fabricators and users of pre-fabricated beams as a control of the quality of the beams. The experimental techniques used are outlined. (J.S.R.)

**43763** RADIOISOTOPES AS INDUSTRIAL TOOLS IN CANADA. O'Riley, L. J. (Atomic Energy of Canada Ltd., Ottawa). Eng. J., 47: No. 5, 44-7(May 1964).

A review of industrial radioisotope utilization in Canada during the past 10 years is presented. Industrial applications of radioisotopes such as leak detection, location of sewer lines, chip tracing in the pulp and paper industry, studies of track wear on railways, and flow pattern studies in bodies of water are described. Safety aspects of radioisotopes and industrial savings realized as a result of their use are also described. (R.C.K.)

**43764** LOW-ENERGY NUCLEAR PHYSICS AND THE DEVELOPMENT OF NUCLEAR APPLICATIONS. Facchini, Ugo (Centro Informazioni Studi Esperienze, Milan). Euratom Bull., 5: 80-4(Sept. 1966).

A review of low-energy nuclear physics is presented. Applications of nuclear physics in engineering, such as in the design of new types of reactors, thermonuclear fusion, and radioactivity monitoring devices, are described. The application of radiation to the solution of problems in industry, medicine, and agriculture is also suggested. (R.C.K.)

**43765** APPLICATIONS OF THE KRYPTONATES IN MATERIALS RESEARCH. Carden, Joan E. Isotop. Radiat. Technol., 3: 318-28; 337(Summer 1966).

The applications of Kryptonates in materials research are reviewed, and both feasibility studies and field applications are included. The uses of Kryptonates in the study of some factors related to friction, including surface temperature, oxidation, and wear; high-temperature oxidation kinetics; corrosion; photodegradation; phase changes; and solids under stress are discussed. (auth)

**43766** AEC FOOD-IRRADIATOR PROGRAM. Lafferty, Robert H. Jr. Isotop. Radiat. Technol., 3: 340-9; 378-9 (Summer 1966).

Irradiation facilities that are being built in the AEC food-irradiation program are described. These irradiators, which have capacities ranging from that needed for university research to that required for semicommercial operations, use $^{60}$Co or $^{137}$Cs as a source of radiation. Essential characteristics such as source strength, production capacity, radiation dose range, and cost are given for some research irradiators. (auth)

**43767** 1965 JOINT COMMITTEE FOOD-IRRADIATION HEARINGS. Isotop. Radiat. Technol., 3: 349-65; 379(Summer 1966).

A full summary of hearings on irradiation processing of food, held by the Joint Committee on Atomic Energy on June 9 and 10, 1965, is presented. Testimony of 20 witnesses from industry, AEC, and the Department of the Army is given, with some of the questions and answers that followed formal testimony. (auth)

**43768** THE QUALITY AND WHOLESOMENESS OF RADIATION-PASTEURIZED MARINE PRODUCTS, WITH PARTICULAR REFERENCE TO FISH FILLETS. Slavin, J. W. (Bureau of Commercial Fisheries, Gloucester, Mass.):

Nickerson, J. T. R.; Ronsivalli, L. J.; Goldblith, S. A.; Licciardello, J. J. Isotop. Radiat. Technol., 3: 365-78; 379-81(Summer 1966).

Low-energy gamma irradiation and conventional pasteurization processes act similarly to extend the shelf life of foods under refrigeration. Radiation pasteurization of fish is discussed in relation to general requirements for pasteurized foods. In addition acceptability and wholesomeness research, spoilage, microbiological contamination, commercial procedures for handling fish, and certain safety aspects of the product are reviewed. Radiation pasteurization is compared with other pasteurization techniques. A review of the literature on marine-product preservation and recent work on fish fillets indicated that radiation-processed foods are high in quality, acceptability, wholesomeness, and nutritional value. The quality of the foods depends on their biological properties, dose levels, storage temperature and environment, and quality of the starting material. Large-scale acceptability tests showed that radiopasteurized fillets of haddock, cod, and petrale sole compared very favorably with fresh-frozen controls. Animal and human feeding studies showed that a number of types of radiation-processed fish are both nutritious and wholesome. At doses below 0.15 Mrad, microbiological changes in irradiated fish are of the same general character as those occurring in other pasteurization processes; spoilage is just as recognizable in irradiated as in pasteurized products and appears similar. Studies on haddock fillets indicated that fish muscle is a poor substrate for growth of Clostridium botulinum type E. In experiments conducted thus far, haddock fillets, inoculated with excessively higher numbers of botulinum spores than those found to occur normally, underwent organoleptic spoilage. (auth)

**43769** RADIOISOTOPES IN ROMANIA. Gerrard, Martha. Isotop. Radiat. Technol., 3: 384-9(Summer 1966).

Preparation of radioisotopes and labeled compounds is described. Uses of radiation sources in chemicals manufacture, measuring instruments, agriculture and forestry, and the use of tracers in chemical analysis, studies of chemical and physical reactions, the chemical industry, petroleum industry, mining, pharmaceutical industry, hydrology, and medicine are discussed. (M.C.G.) •

**43770** GAMMA IRRADIATION AS A MEANS OF EXTENDING THE STORAGE LIFE OF HADDOCK FILLETS. Power, H. E.; Fraser, D. I.; Neal, W.; Dyer, W. J.; Castell, C. H. (Fisheries Research Board of Canada, Halifax, N. S.). J. Fisheries Res. Board Can., 21: 827-35 (July 1964).

Studies of the storage life of iced haddock (Melanogrammus aeglefinus) fillets after treatment with doses of gamma radiation of 75,000, 150,000, and 250,000 rads, have shown that a useful extension of the storage life is made possible by irradiation. The fillets irradiated with the 75,000-rad dose and assessed after cooking because unacceptable after about 25 days at 0°C. The unirradiated control became unacceptable after 12 days. Fillets irradiated at the two higher levels were of lower quality initially than the fillets irradiated at the 75,000-rad level but showed no significant decrease in acceptability up to 27 days storage in ice. Raw fillets developed an objectionable odor and appearance just prior to becoming unacceptable to the taste panel. (auth)

**43771** DIRECT AND INDIRECT EFFECTS OF RADIATION: THEIR RELATION TO GROWTH. Cook, A. M.; Berry, R. J. Nature, 210: 324-5(Apr. 16, 1966).

Attempts are made to disqualify claims made by Holsten, Sugii, and Steward in "Direct and Indirect Effects of Radiation on Plant Cells: Their Relation to Growth and Growth Induction" that the work reported in the article has implications for the radiosterilization of food. (H.G.D.)

**43772** RADIATION STERILIZATION OF FOOD. Goldblith, Samuel A. (Massachusetts Inst. of Tech., Cambridge). Nature, 210: 433-4(Apr. 23, 1966).

Attempts are made to disqualify claims made by Holsten, Sugii, and Steward in "Direct and Indirect Effects of Radiation on Plant Cells: Their Relation to Growth and Growth Induction" that radiation effects can be transmitted indirectly to cells by stable, toxic radiolysis products derived from irradiated sugars and that work reported in the article has implications for the radiosterilization of food. (H.G.D.)

**43773** EFFECT OF GAMMA RAYS ON STORAGE LIFE AND CHIPPING QUALITIES OF ONTARIO GROWN KENNEBEC POTATOES. Gardner, D. S.; MacQueen, K. F. Potato Chipper, 24: No. 9, 38; 42; 46; 50; 54; 58(May 1965).

A series of experiments is described in which 48,000 pounds of Kennebec potatoes were irradiated in a mobile irradiator. Approximately one ton of potatoes per hour were processed with an average gamma dose of 8,000 rads. It was found that this treatment effectively inhibits sprouting in Ontario grown Kennebec potatoes for up to ten months under controlled storage conditions. At this dosage level there did not appear to be any undesirable side reactions that affected the chipping quality of potatoes. (R.C.K.)

**43774** THE UNITED STATES ATOMIC ENERGY COMMISSION PROGRAMME ON MARINE PRODUCTS IRRADIATION. Shea, K. G. (United States Atomic Energy Commission, Washington, D. C.). pp 19-38 of STI-DOC-10/54.

The USAEC program organization on radiation treatment of marine products is described. Various elements of the program including microbiology, facility design, construction and economics are reviewed and analyzed. The importance of the Clostridium botulinum, type E, question is discussed. The design, capabilities, and proposed use of the marine products pilot x irradiation plant, located at Gloucester, Massachusetts are described and an evaluation is made of the present status and future outlook. (C.H.)

**43775** A DISCUSSION OF THE RADIATION PRESERVATION OF FISH IN DEVELOPING COUNTRIES. Rhodes, D. N. (Agricultural Research Council, Cambridge, Eng.); Roberts, T. A.; Hobbs, G. pp 39-63 of STI-DOC-10/54.

The present knowledge concerning the preservation of fish by radiation pasteurization and sterilization processes is discussed in relation to the application of these processes in the developing countries. Organoleptic, bacteriological, technological, and economic factors are considered. The role of Clostridium botulinum, type E, as a pathogen of special significance in radiation pasteurization of fish, and the properties and growth characteristics of the spores of this organism are described. The recorded occurrence of food poisoning incidents attributed to this organism and the current ecological information are collated. (auth)

**43776** RESEARCH IN THE USSR ON THE CONSERVATION OF FISH AND FISH PRODUCTS BY GAMMA IRRADIATION. Kardashev, A. V. (All-Union Research Inst., Moscow). pp 65-72 of STI-DOC-10/54.

Results are summarized from studies on the effects of $\gamma$ radiation on different types of fish and fish products. Results showed that $\gamma$ rays from $^{60}$Co can be used to prolong the storage time for fresh fish (by irradiation with pasteurizing doses and, for certain types of fish, with sterilizing doses). It was also possible to prepare stable fish conserves using irradiation doses of 1.5 to 2.0 Mrad. The effects of $\gamma$ irradiation on the storage life and taste of anchovies, cooked fish, salted fish, smoked fish, and pickled fish are described. (C.H.)

**43777** INSECT INFECTION OF AFRICAN DRIED OR SMOKED FISH AND THE POSSIBILITY OF ITS CONTROL BY IRRADIATION. Daget, J. (Chad Research Center, Fort-Lamy, France). pp 73-83 of STI-DOC-10/54.

Most fishing interests in the interior of Africa find it impossible to arrange the transport of fresh fish from the fishing grounds to the centers of consumption and storage. Moreover, resort to deep-freezing or simple refrigeration is impossible or too expensive. It is therefore necessary to dry or smoke, on the spot, all fish which is not immediately consumed by the local population. Drying and smoking offer many advantages in the developing countries, including low preparation costs, high nutritional value for low weight, and preservation and transport facilities. However, the dried or smoked fish is attacked by insects of the genera Dermestes and Necrobia and the damage is all the more serious since the fish is stored in large quantities. Chemical methods of disinfestation involve serious disadvantages. An attractive solution appears to be irradiation, which leads to the death or sterilization of the insects and which can be employed when the fish is already packed in hermetically sealed containers. (auth)

**43778** DISINSECTIZATION OF AFRICAN DRIED AND SMOKED FISH BY MEANS OF IRRADIATION. Boisot, M. H.; Gauzit, M. (Association for Development of Industrial Applications of Radiation, Paris). pp 85-94 of STI-DOC-10/54.

Fresh water fish are one of the major sources of protein in the diet in Africa. More than 100,000 tons of commercial fish are removed from the Niger basin annually and 150,000 tons are removed from the Chad basin. The fish are dried or smoked and shipped throughout Africa. More than 30 wt % of the fish are destroyed each year by insect infestation and none of the conventional methods of combating these insects has produced practical results. Results are reported from a series of studies carried out in France on the control of insect infestations in dried or smoked fish by exposure to $\gamma$ radiation. Data are included from entomological studies on Dermestes and Necrobia; radiation doses necessary to kill these insects during various developmental stages in dried or smoked fish; the effects of doses of 20,000 to 500,000 rad $\gamma$ radiation on the taste of dried and smoked fish of several varieties when exposed in polyethylene bags or removed from them; the effects of 15,000 to 30,000 rad $\gamma$ radiation on the nutritional value of fish; and a study of packaging materials for fish to prevent reinfestation after radiation processing. Studies were also made on the economic feasibility of the radiation processing of fish caught in African waters. (C.H.)

**43779** CLOSTRIDIUM BOTULINUM, TYPE E, IN RELATION TO IRRADIATION TREATMENT OF FRESH FISH, WITH SPECIAL REFERENCE TO TROPICAL CONDITIONS. Abrahamsson, K. (Swedish Inst. of Food Preservation Research, Goteborg); Molin, N.; de Silva, N. N. pp 95-103 of STI-DOC-10/54.

Results are reported from a study of the effect of $\gamma$ radiation treatment on fresh fish packed in polythene, with and without vacuum, in relation to the normal spoilage flora. The experiments performed, the methods used, and the results obtained are presented. The results show that vacuum packing of fish inoculated with Clostridium botulinum increased the strength of the toxin formed in the initial stage of storage. However, upon prolonged storage at 20°C about the same amount of toxin was found in samples packed in air, indicating little advantage to vacuum packing of fish. Results at various irradiation dose levels are tabulated. (auth)

**43780** PROSPECTS AND NEEDS FOR RADIATION DISINFESTATION OF PACKED FRUITS AND VEGETABLES. Talhouk, A. S. (American Univ., Beirut). pp 105-13 of STI-DOC-10/54.

In countries with adequate precipitation or irrigation water and high average yearly temperatures the growth of particular crops is favored. The suitable climatic conditions, however, also favor the multiplication of many pests in the stored produce. The problem of insect pests of packed fruits and vegetables, although cosmopolitan, presents a particular concern to the developing countries. The pests that are likely to be controlled by irradiation and are less susceptible to the conventional methods of control are discussed, and recommendations are made as to conventional or radiation control methods. (C.H.)

**43781** RADIATION PRESERVATION OF SOME FRUITS AND VEGETABLES. Dharkar, S. D. (Atomic Energy Establishment, Trombay, India). pp 115-22 of STI-DOC-10/54.

Shelf life extension and radiation processing of certain tropical fruits were studied in the laboratory. It was demonstrated that alfonso mangoes and sapota slices could be kept for one year by first inactivating the enzymes by mild heat treatment and then irradiating to a dose of $4 \times 10^5$ rad $\gamma$ radiation. The irradiated products were equal in acceptance to thermally sterilized controls. Oxidative flavor changes in canned mangoes were minimized when the removal of oxygen was efficient. Vitamin losses in mangoes and sapotas were no more than in thermally sterilized controls. By using a combined treatment in sterilizing orange juice the radiation dose could be lowered from 800 to 400 krad by a post-heat treatment of 15 min at 50°C. Better retention of ascorbic acid, thiamine, and riboflavin were obtained. Peas in brine sterilized by irradiation at 850 krad were found to be superior in flavor, color, texture, and overall quality to thermally processed controls. Shelf-life extension of mangoes by delaying the ripening with irradiation was found to be effective at doses between 1200 and 2500 rad. Such a treatment would be useful in regulating ripening of such fruit for canning factory purposes. No difference could be found between irradiated and non-irradiated canned mangoes. In studying the inhibition of the sprouting of potatoes and onions by irradiation it was found that different varieties required different doses and those products approaching the break in dormancy required higher doses. Other work in radiation preservation showed that certain microorganisms were more sensitive to radiation when previously subjected to ultrasonic treatment. With yeasts there seemed to be a different mode of action in killing the cells at high and low frequencies. Research on combining radiation treatment with cold storage of fruits to extend shelf life shows promise. Work is also being done on the use of irradiation treatment to reduce microbial contamination in freeze-dried products. (auth)

**43782** USE OF IONIZING RADIATIONS TO PROLONG THE STORAGE LIFE OF FRUIT AND BERRIES (REVIEW OF WORK IN THE USSR). Rogachev, V. I. (All-Union Research Inst., Moscow). pp 123-42 of STI-DOC-10/54.

The irradiation of fruit is considered as a factor influencing the microflora of fruits and the physiological and biochemical processes occurring during the storage of fruit. Results are reported from studies on the effect of irradiation on microorganisms which cause fruit and berries to spoil; the spoiling of fruits caused by repeated infection by microflora; the biochemical processes occurring in fruit while stored; the ripening of fruit during storage; the periods for which fruits of varying degrees of ripeness can be stored; and opportunities for the industrial processing of fruit. The results of experiments on the storage of irradiated fruits and berries include strawberries, raspberries, blackcurrants, cherries, apricots, peaches, tomatoes, grapes, mandarines, and subtropical persimmons and figs. Recommendations are made as to optimum irradiation doses for prolonging the periods during which these fruits and berries can be stored. (auth)

**43783** IRRADIATION STUDIES OF FRUIT AND VEGETABLES IN LATIN AMERICA. Sanin-Sader, J. pp 143-5 of STI-DOC-10/54.

A short discussion on the population and food situation in Latin America is followed by the need for research on certain agricultural products for local use and on items for export upon which the economy of several countries depends. Radiation research on the sprout inhibition of potatoes indicates that between 8 and 10 krad are sufficient to delay sprouting for seven to eight months, which in many countries is sufficient to hold the product until the next harvest. The losses caused by ripening during the export shipment of bananas is about 25% and radiation studies to delay ripening show promise in reducing this loss. The same is true of the work on the papaya and there are indications that it may be possible to ship this product for long distances after radiation treatment. (auth)

**43784** DATA ON RADIOSENSITIZATION OF FRUIT-SPOILAGE FUNGI BY CHEMICAL SENSITIZERS. Georgopoulos, S. G.; Georgiadou, E.; Macris, B. (Greek Atomic Energy Commission, Athens). pp 147-9 of STI-DOC-10/54.

In continuing studies on the possibilities of radiosensitizing spores of fungi important for fruit preservation by chemical means, mixtures of spore suspensions and solutions of the test compound are exposed to sublethal doses of $\gamma$ radiation. The survival fraction is estimated by the viable cell count technique. Vitamin $k_5$ is toxic to both Penicillium italicum and Pullularia pullulans at room temperatures. A radiosensitizing effect has been observed but its magnitude cannot be easily recognized because of the high toxicity. 1-Naphthol, structurally related to the vitamin $k_5$ compound, is not toxic to the fungi used. This substance is a very good radiosensitizer for Candida tropicalis (a yeast) P. pullulans (a pseudosacharomycete) and probably Rhodotorula sp. (another yeast) in air. In contrast, P. italicum, Botrytis cinerea, and Aspergillus niger (all filamentous fungi) could not be sensitized by 1-naphthol. For P. italicum experiments were conducted in both air and nitrogen and the results were negative. Maleic acid does not seem to be of interest for the sensitization of either P. italicum or P. pullulans. (auth)

**43785** RADIOSENSITIVITY OF PURIFIED AND CRUDE PECTIC ENZYME PREPARATIONS. Vas, K.; Proszt, G. (College of Horticulture and Viticulture, Budapest). pp 151-8 of STI-DOC-10/54.

Solid and liquid preparations containing pectic enzymes of fungal origin can successfully be sterilized by relatively high doses (around 1 Mrad) of ionizing radiations without appreciable damage to enzyme activity. In contrast, pectolytic enzymes in the purified state proved to be rather radiosensitive. Purification has been achieved by fractionation on Sephadex gel columns. Combining the pure enzyme solution with certain other fractions obtained by the gel filtration procedure, partially or completely restored the original radio-resistance of the enzymes as found in the crude preparation. Attempts were made to characterize the radio-protective substances, and it is probable that the most effective fraction contains purin and/or pyrimidin derivatives. A closer identification of these substances is under way. It is hoped that knowledge of these compounds will prove to be of value in regulating enzyme sensitivity in a positive or in a negative sense to suit the varying needs of the food technologist. (auth)

**43786** REPORT OF THE MEETING OF THE FAO/WHO/IAEA EXPERT COMMITTEE ON THE TECHNICAL BASIS FOR LEGISLATION ON THE WHOLESOMENESS AND MICROBIOLOGICAL SAFETY OF IRRADIATED FOOD. Goresline, H. E. (Atomic Energy Branch, Food and Agriculture Organization, Rome). pp 173-5 of STI-DOC-10/54.

Since the report of the subject meeting was not yet available to the panel a narrative description was presented on the: formation and composition of the Committee; the terms of reference; the general subjects of discussion; and a generalized list of the recommendations. This information was designed to be of assistance to the panel during certain portions of their discussions on the possible use of irradiation in the processing of food. (auth)

**43787** PROBLEMS OF THE PASTEURIZATION OF FRUIT JUICES BY IRRADIATION. Kaindl, K.; Altmann, H.; Gaisch, H.; Prosenz, K.; Stehlik, G. (Institute of Biology and Agriculture, Reactor Centre, Seibersdorf, Austria). pp 177-80 of STI-DOC-10/54.

Some of the problem areas involved in fruit juice preservation by irradiation and some of the approaches that are being utilized in research to solve these problems by the group working at the Seibersdorf Laboratories are discussed. The radiation biology of yeasts is reviewed and the combined use of heat and radiation to control the growth of yeast in fruit juice is described. (C.H.)

**43788** DEVELOPMENT OF WEAR AND THE STATISTICAL ASPECT OF THE RADIOACTIVE ISOTOPES MEASURING METHODS. Pavelescu, D. Stud. Cercet. Mec. Apl., 20: 1305-22(1965). (In Rumanian).

Investigations conducted on models and industrial equipment to correlate dynamic and statistical laws relating to friction wear are described. Radiometric analysis was found to be a valuable tool in the study of wear problems. (TSS)

**43789** AVTOMATICHESKII KONTROL I REGULIROVANIE PROIZVODSTVENNYKH PROTSESSOV S PRIMENENIEM YADERNYKH IZLUCHENII. (Automatic Control and Nuclear Radiation Control of Industrial Processes). Smolyak, V. A.; Uzlyuk, V. N. Moscow, Atomizdat, 1966. 148p.

Applications of radioisotopes and nuclear radiation in the investigation and automatic control of processes in the mining, metallurgy, chemical, and machine building industries are discussed. A brief review is given of the uses of isotopes and radiations in investigations of technological processes and automated equipment. Economic aspects of radioisotopic devices in industrial control are also discussed. 441 bibliographics are included. (R.V.J.)

**43790** LES RADIOELEMENTS, FACTEURS DE PROGRES ECONOMIQUE. (The Radioelements, Factors of Economic Progress). Nils, Albert. Paris, Dunod, 1966. 223p.

The concepts of nuclear physics are briefly reviewed and a history is given of the development of nuclear energy and the utilization of radioisotopes. The application of ionizing radiations in chemical research, medicine and biology, agriculture, and industry is discussed with emphasis on economic aspects. The relation between the use of radioisotopes and economic progress is considered by a discussion of radioisotopes in nuclear industry, the conditions for economic progress, correlation between technical and economic progress, factors of extension and limitation of the use of radioisotopes, and the forms of progress. The roles of nuclear energy and radioisotopes in economic development are summarized. (J.S.R.)

**43791** VERSATILE $^{60}$Co IRRADIATION FACILITY WITHIN A SWIMMING-POOL REACTOR. Lapidot, M.; Haram, S.; Bar-on, I.; Satchy, C.; Kahan, R. S. (Soreq Nuclear Research Center, Yavne, Israel). Vienna, International Atomic Energy Agency, 1966, Preprint SM-73/51, 16p. (CONF-660609-8). ORAU.

From International Symposium on Food Irradiation, Karlsruhe, Ger.

The IRR-1 enriched-fuel swimming-pool type reactor incorporates a concrete-shielded gamma cell for using the radiation from spent fuel elements. A versatile $^{60}$Co irradiation facility was added at relatively low cost. The 30,000 $^{60}$Co source runs on a carriage at the bottom of the reactor pool. The source plaque completely covers the Al window between the pool and the irradiation cell. This geometry allows for a "source to target" overlap; therefore, dose rate homogeneity within ±20% is attained inside two commercial cases (43 × 31 × 31 cm) or two commercial sacks (80 × 45 × 45 cm) and within ±10% in two flat boxes (40 × 20 × 5 cm) irradiated simultaneously. A set of steel and aluminium screens attached to two rotating turntables permits irradiation of commercial cases at any desired dose rate smaller than 100,000 r/hr without need for overturning at half-time. Two special underwater canisters allow long-term irradiation of flat specimens at dose rates less than 600,000 r/hr, while the source is used for normal short-term irradiations in the gamma cell. Safety is ensured by a visible and audible indicator and alarm system and by an elaborate interlock system. A system of ionizing gages and recorders permits measurement of dose rates over the range from 0.001 to 1,000,000 r/hr. Isodose curves for the irradiation chamber have been determined. The disadvantages of low source utilization inherent in required source-to-target overlap and of one-sided utilization of the radiation are more than compensated for by the possibility of pilot-scale irradiation of commercial cases and by the greater versatility and low cost. This installation is, therefore, recommended for all similar swimming-pool reactors. (auth)

**43792** LARGE SCALE APPLICATIONS OF RADIATION FOR NEW MATERIALS. Harmer, D. E. (Dow Chemical

Co., Midland, Mich.). 6p. (CONF-660305-21). ORAU. Gmelin, AED-CONF-66-038-7.

From American Nuclear Society Topical Meeting, Augusta, Ga.

This paper attempts to answer the question, "Are there any really new materials that can be successfully made by the application of large scale sources of radiation?" The uses of radiation sources in connection with large scale processes for polymerization of vinyl compounds in the presence of wood, graft copolymerization between styrene monomers and polyvinyl chloride, graft copolymerization of polyethylene and acrylic acid, polymerization of trioxane directly from the crystalline form, and manufacture of ethylene bromide by reaction of ethylene and HBr using a $^{60}$Co source as a "catalyst" are reviewed as past accomplishment in the field. (B.L.M.)

**43793** IDENTIFICATION OF BACTERIA ISOLATED FROM IRRADIATED AND NONIRRADIATED YELLOW PERCH FILLETS. Kazanas, Nuria. 16p. (CONF-660539-2). ORAU. Gmelin, AED-CONF-66-114-2.

From American Society for Microbiology, 66th Annual Meeting, Los Angeles.

A genera-related study was made of bacteria isolated from irradiated and nonirradiated fresh yellow perch (Perca flavescens) fillets during the course of microbial spoilage at refrigerator temperatures. Microbiological assays consisted of total aerobic and facultative microbial plate counts employing TPY medium, as well as yeast and mold plate counts employing malt agar medium. Nonirradiated samples were evaluated initially for the native flora plus contaminants, and then routinely for increases in gross population changes during refrigerated storage (1°C). Irradiated fillets received $^{60}$Co doses of 0.1, 0.2, 0.3, and 0.6 Mrad. Pseudomonas, Achromobacter, and Flavobacterium contributed significantly to the total flora and were initially found in comparable amounts. Two fresh fish spoilage patterns were observed: Pseudomonas and Achromobacter appeared to be the main contributors to fillet spoilage in nonirradiated fillets, whereas it is indicated that spoilage in irradiated fillets may be attributable to Achromobacter and yeasts. (H.G.D.)

**43794** SHALLOW IRRADIATION OF ORANGES BY ELECTRONS. A FEASIBILITY STUDY FOR IN-LINE PROCESSING. Benn, Thomas R. (High Voltage Engineering Corp., Burlington, Mass.). Washington, D. C., American Chemical Society, 1965, 16p. (CONF-650902-23). ORAU. Gmelin, AED-CONF-65-235-3.

From American Chemical Society, 150th National Meeting, Atlantic City.

The paper reviews some experimental data developed to bridge the gap between research and commercial application of irradiation energy. For convenience these studies were performed with oranges but the techniques apply to all fruits and indeed spherical shapes where only shallow penetration by electrons is required. The work was designed to generate and present data in a manner which will be meaningful to processers who generally are not expert in irradiation technology. The work was continued to a point where in-line processing could be contemplated. The domestic (U. S.) commercial situations for fruit do not support the construction of a pilot-plant at this time. (auth)

**43795** CONSUMER EVALUATIONS OF SOME MEAT PRODUCTS STERILIZED BY IRRADIATION AT LOW TEMPERATURES. Kauffman, F. L. (Swift and Co., Chicago); Harlan, J. W.; Heiligman, Fred. 24p. (CONF-660111-1). ORAU. Gmelin, AED-CONF-66-001-3.

From American Chemical Society, Winter Meeting, Phoenix, Ariz.

Ten different items representing five different meats, that were radiation-sterilized while at a temperature near liquid nitrogen, were evaluated by consumer panels for acceptance, and by a trained expert panel for irradiation flavor intensity. The consumer panels rated the irradiated samples as good as, or better than, the nonirradiated frozen control in four of the ten items tested. Acceptance scores and comments were sufficiently favorable to suggest that the consumers did not find any of the irradiated items objectionable. The expert panel rated the irradiated samples on an average midway between little and very little for irradiation flavor intensity. Expert panel scores were useful in verifying the importance of irradiation flavor in interpreting overall acceptability scores. (auth)

**43796** RADIATION STERILIZATION DEVICE WITH UNIFORMLY DISTRIBUTED BETA EMITTERS. Levin, Harry; Bareis, David W.; Bitterly, Jack G. (to Marquardt Corp.). U. S. Patent 3,264,473. Aug. 2, 1966. Filed June 26, 1963.

A device is presented which uses very small particles of $^{147}$Pm uniformly distributed on a plate so as to produce maximum efficiency in the use of emitted radiations. The size and spacing of radioactive particles is designed to provide minimum absorption between particles and minimum self-attenuation. Shielding problems are minimized through the use of $^{147}$Pm, a beta emitter, since only weak x rays are produced by its beta particles. (W.E.B.)

## Power Application

***See also* ENGINEERING — Space Propulsion**

**43797** (AGN-8163(Vol.3)) RADIOISOTOPE APPLICATIONS IN HYDROSPACE. VOLUME III. FUEL SPECIFICATION. Final Report. (Aerojet-General Nucleonics, San Ramon, Calif.). Feb. 1966. Contract AT(04-3)-368. 52p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

The use of cobalt-60 as a heat source for a small undersea craft, the Radio Isotope Submersible Engine (RISE) is described. Preliminary fuel specifications for the conceptual design of the heat source are reported. The specific activity will be 200 C/g with total activity of 1.59 MC. The outer container will be Hastelloy C with an overall diameter of 0.866 in. and an overall length of 5.640 in. The maximum fuel temperature is <1500°F. (F.S.)

**43798** (ALO-3634-2) VACUUM FOIL-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS. Quarterly Progress Report, May-July 1966. Dunlay, J. B.; Paquin, M. L.; Poirier, V. L.; van Someren, L. (Thermo Electron Engineering Corp., Waltham, Mass.). Aug. 30, 1966. Contract AT(30-1)-3634. 51p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Both the compatibility screening and planar thermal conductivity test assemblies were completed and tests were initiated. Results of the 100 hour and 500 hour compatibility tests are presented. Heat loss measurements through a 40 layer $Ta-Y_2O_3$ insulation sample are described. A heat flux of 0.55 watts/cm$^2$ was obtained for the 1700°C hot side temperature. Analytical techniques of correlating the experimental data are discussed. Preliminary designs are shown for the support insulation heat loss and soak test assemblies which will be fabricated during the next quarter. (auth)

**43799** (NP-16281) SUMMARY OF RISE POWER CONVERSION SYSTEM SELECTION. Carney, H. C. (Aerojet-General Nucleonics, San Ramon, Calif.). Oct. 1965. 24p.

The results of a study of dynamic power conversion systems for RISE—RadioIsotope Submersible Engine—are reported. Rankine, Brayton, and Stirling thermodynamic cycles were considered; and a number of working fluids and prime movers were investigated. The study included cycle analysis (stressing the determination of practical system performance and optimum operating conditions), specification of the design and operating characteristics of the prime mover and power conversion system components, and an evaluation of current technology status. The systems were compared and the Dowtherm-A Rankine cycle power conversion system selected as best satisfying RISE design criteria and operational objectives. (auth)

# Separation and Production

## See *also* CHEMISTRY — Separation Processes and Procedures

*Refer also to abstract 43874.*

**43800** (BNWL–140(Rev.1)) FORMATION OF TRANSURANIUM ISOTOPES IN POWER REACTORS. Deonigi, D. E. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Jan. 1966. Contract AT(45-1)-1830. 227p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

Yields of transuranium isotopes from different fueling methods are presented in tables consisting mostly of computer printouts. Most of the values were derived from simulated water reactors. The ALTHEA computer code was used on an IBM 7090. The isotopes formed from each of the 24 cases considered appear in two tables: fuel properties and properties of special products. (M.C.G.)

**43801** CHEMISTRY OF ELECTROMAGNETICALLY SEPARATED ISOTOPES. Greene, R. E. Isotop. Radiat. Technol., 3: 312-15; 316-17(Summer 1966).

The chemical purification of stable isotopes electromagnetically enriched at Oak Ridge National Laboratory is reviewed and the purification methods for isotopes of chromium, platinum, and osmium are given. Isotopes of chromium are separated from perchloric acid solution as the trioxide, reduced with hydroxylamine sulfate, precipitated as the hydroxide, and ignited to $Cr_2O_3$. Platinum isotopes are precipitated as ammonium chloroplatinate, which is ignited, and the resultant platinum sponge is further ignited in hydrogen. Isotopes of osmium are volatilized as $OsO_4$, collected in hydrobromic acid, precipitated as hydrated $OsO_2$, and reduced with hydrogen to metallic osmium, the preferred inventory form. (auth)

**43802** RADIOISOTOPE PRODUCTION BY NUCLEAR EXPLOSION. Gerrard, Martha. Isotop. Radiat. Technol., 3: 315-16(Summer 1966).

The distribution of $^{242}Cm$, $^{241}Am$, $^{238}Pu$, $^{228}Th$, $^{210}Po$, $^{204}Tl$, and $^{3}H$ from a nuclear explosion in a salt deposit and the means by which these nuclides might be recovered are discussed. Data indicated that the most important minerals formed by reactions of the rock with the atmosphere and with materials introduced into the shot room or by reactions among the rock components were magnetite, olivine, kirschtenite (or monticellite) with considerable iron substitution, and lead compounds. Activity was distributed in the lower third of the cavity but inhomogeneously. (M.C.G.)

**43803** PRODUCTION OF ISOTOPES IN COMMERCIAL REACTORS. Slosek, T. J. 16p. (CONF-660305–22). ORAU. Gmelin, AED-CONF-66-038-4.

From American Nuclear Society Topical Meeting, Augusta, Ga.

The background of the production of radioisotopes by both AEC and commercial producers is surveyed. The commercial production for large-scale applications of $^{142}Ir$, $^{60}Co$, and $^{170}Tm$ is discussed in some detail. (B.L.M.)

$O_3$. Platinum
roplatinate,
sponge is fur-
are volatilized
cipitated as hy-
etallic osmium,

Y NUCLEAR
diat. Technol.,

Th, $^{210}$Po, $^{204}$Tl,
osit and the
vered are dis-
nt minerals
sphere and
or by reac-
tite, olivine,
le iron sub-
istributed in
sly. (M.C.G.)

OMMERCIAL
0305–22).

eeting, Au-

otopes by
ed. The
tions of
il. (B.L.M.)

---

# MATHEMATICS AND COMPUTERS

*Refer also to abstract 42698.*

**43804** (LA–3546) ADMINISTRATION OF SECONDARY STORAGE IN NUCLEAR CODES. Worlton, William J. (Los Alamos Scientific Lab., Univ. of California, New Mex.). June 14, 1966. Contract W-7405-eng-36. 51p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

The importance of secondary storage in nuclear codes is discussed, together with the components and organization of storage systems. A review and evaluation of secondary storage devices is presented. (D.C.W.)

**43805** (ORNL-3980) AN ALGORITHM FOR A FORM OF THE PROBLEM Av = λ Bv. Arnurius, D. E. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 57p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Thesis. Submitted to Tennessee Univ., Knoxville.

An investigation was made to find a nonnull vector v and an associated scalar λ, real or complex, to satisfy $Av = \lambda Bv$ where B is a positive definite and A is normal with respect to B. A matrix A is normal with respect to the positive matrix B in case $AB^{-1}A^H = A^HB^{-1}A$. If $B = I$, the identity matrix, then $Av = \lambda Bv$ is the proper-value, proper-value problem for a normal matrix A. The problem is written in the form $Mv = \lambda v$ with $M = B^{-1}A$. An algorithm is described that will provide successive approximations to a proper vector and its associated proper value for the matrix M or provide a sequence of vectors that converges to an invariant subspace $\tau$ of M. (M.O.W.)

**43806** (ORNL–4008) ON SOLVING SYSTEMS OF POLYNOMIALS IN SEVERAL INDETERMINATES. Ramsey, D. C. (Oak Ridge National Lab., Tenn.). Oct. 1966. Contract W-7405-eng-26. 87p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Thesis. Submitted to Univ. of Tennessee, Knoxville.

Consider the problem of finding all common zeros of a system $P_i(X_1, X_2, \ldots, X_m)$ for $i = 1, 2, \ldots, n$ where each $P_i$ is a polynomial in the indeterminates $X_1, X_2, \ldots, X_m$. Kronecker devised a method for solving such a system. A system of polynomials (called a resultant system) which contains in its set of common zeros the set of common zeros of the system is found. Such a resultant system consists of a set of polynomials. $R_i(X_1, X_2, \ldots, X_m)$ for $i = 1, 2, \ldots, n'$ where $n' \leqq n$ and $R_j$ for $j = p + 1, p + 2, \ldots, n'$ is free of one indeterminate which appears in $R_p$ where $1 \leqq p < n'$. The resultant system can be solved by finding solutions to $R_{n'}$ and then working back through $R_{n'} - 1$, etc., to find m-tuples that are solutions of the resultant system. Two methods are discussed for arriving at a resultant system for a system of polynomials. A system of computer subroutines were written for manipulating polynomials over a finite field. These subroutines were incorporated into a computer program for finding a resultant system of polynomials (over a finite field) using one of the methods discussed. (auth)

**43807** CLASS OF REPRESENTATIONS OF THE GENERALIZED BONDI-METZNER GROUP. Cantoni, Vittorio (King's Coll., London). Contract AF 61(052)-877. J. Math. Phys. (N. Y.), 7: 1361-4(Aug. 1966).

A procedure is given for the construction of a faithful linear representation of the generalized Bondi-Metzner group from each faithful linear representation of the inhomogeneous orthochronous Lorentz group. Unitary representations can be obtained in this way. (auth)

# METALS, CERAMICS, AND OTHER MATERIALS

## General

*Refer also to abstract 43473.*

**43808** (BNL-991) HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW. A Bimonthly Technical Progress Review. Volume 4, Number 2. (Brookhaven National Lab., Upton, N. Y.). Apr. 1966. Contract AT-30-2-GEN-16. 58p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Information is summarized on progress in the categories physical properties and thermodynamics, fluid dynamics, heat transfer, materials development and corrosion, instrumentation, component development, systems studies, chemistry and chemical analysis, and fabrication techniques. (J.R.D.)

**43809** (BNL-50003) HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW. A Bimonthly Technical Progress Review. Volume 4, Number 3. (Brookhaven National Lab., Upton, N. Y.). June 1966. Contract AT(30-2)-Gen-16. 52p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Included are summaries of 23 research projects dealing with the following aspects of high-temperature liquid-metal technology: physical properties and thermodynamics, fluid dynamics, heat transfer, materials development and corrosion, instrumentation, component development, systems studies, chemistry and chemical analysis, and fabrication techniques. (M.O.W.)

*For abstracts of individual sections see: 43811, 43812, 43848, 43988, and 43989.*

**43810** (BNWL-269) CERAMICS RESEARCH AND DEVELOPMENT QUARTERLY REPORT, OCTOBER-DECEMBER 1965. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Contract AT(45-1)-1830. 124p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Research is summarized in five parts. Separate abstracts were prepared for each part. (J.R.D.)

**43811** (BNWL-269, pp 1.1-28) CERAMIC FUEL RESEARCH STUDIES. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

Research Progress is reported on thermal diffusivity of MTR-ETR fuel elements, electric conductivity of $UO_2$, thermal conductivity of $UO_2$, thermal conductivity of $LiAlO_2$, phase studies of Pu oxides, crush strength of $UO_2$ and $PuO_2$ particles, induction heating of $ThO_2$, stoichiometry of U oxides, phase studies of actinide oxides, synthesis of substoichiometric Pu and U oxides, work function measurement ments on Ta and ZrC, furnaces for DTA measurements, high-temperature dilatometers for Pu fuels, high-temperature glove boxes for Pu ceramic fuels, and preparation of $PuO_2-UO_2$ powders. (J.R.D.)

**43812** (BNWL-269, pp 4.1-9) JOINT FUEL DEVELOPMENT PROGRAMS. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

Development work includes irradiation testing of EBWR prototype fuel rods, and ultrasonic examination of Saxton tubing. Plans for irradiation of Phoenix fuels are discussed along with contracting for experimental SAP end closures. (J.R.D.)

**43813** (COO-1122-3) RECRYSTALLIZATION AND SINTERING OF OXIDES. Technical Progress Report, September 1, 1965-August 31, 1966. Cutler, Ivan B.; Keski, James R.; Petersen, Ronald O.; Wilcock, John L. Jr.; O'Hara, Martin J.; Soong, James C. (Utah Univ., Salt Lake City. Dept. of Ceramic Engineering). Contract AT(11-1)-1122. 132p. Dep. mn. CFSTI $4.00 cy, $1.00 mn.

The following studies are reported: (1) effects of $MnO_2$ on sintering of $Al_2O_3$, (2) effects of water vapor on initial sintering of CaO, (3) effects of Al on sintering of $Al_2O_3$, (4) sintering kinetics of composite compacts of $Al_2O_3$, and (5) interdiffusion studies of transition metal oxides in MgO. (D.L.C.)

**43814** (LA-DC-7581) LIQUID PLUTONIUM FUELS. Kirkbride, L. D. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1966]. Contract W-7405-eng-36. 30p. (CONF-661003-1). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From AIME Nuclear Metallurgy Symposium on High Temperature Nuclear Fuels, Delevan, Wis.

Commercial fast breeder reactor designs presently contemplated would utilize a fuel system of Pu-Co-Ce alloy. Results are presented of several research projects involved in developing the Pu-Co-Ce fuel system. One project is concerned with establishing a corrosion resistant container for liquid Pu alloys. Tests to date have encompassed fuel concentrations from 5 to 8 g Pu/cc in contact with Ta and Ta-W alloys up to 10 wt % W and at temperatures up to 1100°C. The results of these tests indicate that container walls are not penetrated by the diffusion of Pu in grain boundaries but only untreated welds are subject to such penetration. Irradiation results obtained to date are all favorable. A brief description of some results obtained in LAMPRE-I (a 1 MW(t) fast reactor, fueled with Pu-Fe eutectic alloy) is given. Current investigations are concentrated on ascertaining the effect of fission product recoil from Pu-Co-Ce alloys on the damage to both Ta and Ta(W)-C layers by testing in the OWR, a 5 Mw(t) thermal flux research reactor. A significant finding is that all wall fission densities of up to $8 \times 10^{20}$ fissions/cc, fission products recoiled into the tantalum alloy container walls are seen to concentrate and diffuse in particular crystallographic planes to a depth of <2.5 mils. (D.L.C.)

**43815** (NASA-CR-54356) DEVELOPMENT AND EVALUATION OF MAGNETIC AND ELECTRICAL MATERIALS CAPABLE OF OPERATING IN THE 800 DEG TO 1600 DEG F TEMPERATURE RANGE. Third Quarterly Report, June 1, 1965-August 31, 1965. Kueser, P. E.; (and others) (Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.). Sept. 1965. Contract NAS3-6465. 175p.

Magnetic and electrical materials are being developed for use in advanced space electric power systems. Program I is directed at developing high-temperature magnetic material with satisfactory strength for rotor use. Martensitic alloys containing 12 Ni-20 Co-balance Fe with single elements such as Ta, Mo, Nb, Be, or Ti indicated strong age-hardening response and have higher alpha to gamma transformation temperatures than the 15-weight percent Ni alloys. These appear to offer excellent promise as high-strength magnetic materials at elevated temperature up to 1200°F. Additions of 3 to 5 weight percent alloying agents raise the alpha to gamma transformation temperature by approximately 45°F. This weight addition represents a limit whereby good magnetic properties are maintained. Eighteen pre-alloyed atomized powders have been received on the dispersion-strengthened magnetic materials program where magnetic and strength properties to 1600°F are under study. The average particle size was found to be in the 10 to 26 micron range. After isostatic compression at room temperature, sintered compacts made from 14 of the powders ranged from 59 to 82 percent of theoretical density. Preparations for extrusion are underway. Unexpected low rupture ductility for Nivco alloy under test at vacuums of less than $3 \times 10^{-8}$ torr has resulted in a reevaluation of the material and the obtaining of a new heat. Program II will determine the feasibility of high-temperature capacitors using high-quality dielectric materials. A combined multiple slicing-cleavage technique has been developed for yielding 15 wafers of pyrolytic boron nitride from a 1/4-inch block, 1-inch square. A method of electroding and building multi-layer capacitors has been defined. When a satisfactory method of electrode interconnection is developed, $\mu$F-volt/in.$^3$ products of a capacitor capable of operating at 1100°F would be competitive with low-temperature plastic-film capacitors. Program III incorporates development on alkali-metal compatible ceramic-to-metal seals and combinations of materials designed into a stator with a bore seal, a transformer, and a solenoid for investigations of compatibility under electrical and magnetic stress at elevated temperature and under high vacuum. Outgassing studies on ceramic materials have shown that a thirty-minute firing in an atomsphere of 75 percent $N_2-25$ percent $H_2$ at 2597°F plus 10 minutes in vacuum ($5 \times 10^{-6}$ torr at 1832°F) provides the best processing of the material with the least residual outgassing. Component manufacture and the related development techniques for building these units are near completion. Testing and calibration will be initiated during the next quarter at temperature and under high vacuum. (auth)

**43816** (PWA-2877) DETERMINATION OF THE EMISSIVITY OF MATERIALS. Semiannual Progress Report, November 15, 1965–May 14, 1966. Luoma, W. L.; Walek, W. J. (Pratt and Whitney Aircraft, East Hartford, Conn.). June 30, 1966. Contract NAS3-4174. 83p. (NASA-CR-72058).

The testing of coatings applied to AISI-310 stainless steel and Nb−1% Zr was continued during the period. In addition, the study of the adherence, compatibility, and emittance of coatings applied to Be was completed. Analysis of a Nb−1% Zr tube coated with $Fe_2TiO_4$ and tested at 1700°F for 10,000 hours was completed. Earlier work has shown that this coating-substrate combination had adequate adherence and emittance characteristics for space radiator use at 1700°F. Emittance values in the range of 0.88 to 0.84 were obtained during the course of the test. Analysis conducted during this period disclosed the occurrence of limited diffusion of coating constituents into the substrate, diffusion of $O_2$ into the substrate across both the coated and uncoated substrate surfaces, and a small amount of Zr diffusion from the substrate into the coating. The substrate was found to be partially recrystallized after the test, but it was also found to be somewhat harder than would be expected for stress-relieved and partially recrystallized Nb−1% Zr. This hardness increase is attributed to the diffusion of $O_2$ and coating constituents into the substrate. It is felt that a significant portion of this hardening is attributable to specimen preparation and test conditions and is not related to coating-substrate interactions. Testing of an $Al_2O_3$−Al titanate-coated Nb−1% Zr tube was completed, and the specimen was analyzed. During 10,000 hr of testing at 1700°F, the emittance of the tested specimens dropped from 0.87 to 0.80. It was evident that the coating deteriorated during the test, and, therefore, it appears that this coating-substrate combination is not suitable for space radiator use. Testing of AISI-310 stainless-steel tubes coated with $Fe_2TiO_4$ and $Ca_2TiO_4$ was continued at 1350°F. Total test times accumulated at the end of the report period were 13,920 hours for the $Fe_2TiO_4$-coated specimen and 14,920 hours for the $Ca_2TiO_4$-coated specimen. Both specimens have an emittance of about 0.88 at present. Be plates coated with $Ca_2TiO_4$, $Fe_2TiO_4$, or $ZrTiO_4$ were aged for 100, 500, and 1000 hours at 800°F and either 1200°F or 1400°F. Initially, aging was attempted at 1400°F, but excessive Be vaporization occurred, and the higher aging temperature was lowered to 1200°F. All coatings demonstrated adequate adherence and compatibility with Be for 1000 hours at 1200°F, although the bond strength of the $ZrTiO_4$ coating was somewhat weaker than that of the other coatings. Aging produced no changes in the coatings or substrates other than permanently increasing the emittance of calcium titanate to 0.92. $Fe_2TiO_4$ and $ZrTiO_4$ both demonstrated stable emittance values of 0.91 at 900°F. (auth)

**43817** (JPRS-36718) NIOBIUM: METAL OF THE SPACE AGE. Nedokha, I. M.; Chernyi, V. G. Translated from pp 5-6; 15-16; 25-31; 38-41; 44-9; 54-75 of Niobii: Metall Kosmicheskoy Ery, Kiev, 1965. 37p. (TT-66-33149). CFSTI $2.00 cy, $0.50 mn.

A survey is presented of the properties and applications of Nb and its alloys and compounds. Smelting by various methods is considered briefly. The characteristics of Nb which determine its high-temperature performance are described, and methods for surface protection are discussed. Processing of Nb is then considered. Compounds of Nb with O, N, B, Si, S, Be, etc. and their applications (particularly Nb carbides) are discussed. After a survey of the uses of Nb in various technologies, the aerospace and reactor applications of Nb and its alloys are discussed in great detail. (D.L.C.)

**43818** SINGLE-CRYSTAL GROWTH OF CERIUM DIOXIDE FROM LITHIUM DITUNGSTATE SOLVENT. Finch, C. B.; Clark, G. Wayne (Oak Ridge National Lab., Tenn.). J. Appl. Phys., 37: 3910(Sept. 1966). (ORNL-P-2248).

Pure and lanthanide-doped $CeO_2$ crystals were grown on Pt surfaces from a supersaturated solution of $CeO_2$ in $Li_2O \cdot 2WO_3$ by solution transfer from nutrient to seed over an appropriate $\Delta T$. A $\Delta T$ of 25−30°C over a 6-cm span of solution at 1070−1100°C was found suitable for growth of optically clear $CeO_2$ octahedra up to 2 mm on edge. $CeO_2$ crystals doped with lanthanides were grown by adding a single lanthanide sesquioxide, typically in the amount of 0.4 wt % of the total $CeO_2$, to the charge at the start of a run. In this manner limited amounts of $Nd^{3+}$, $Gd^{3+}$, $Dy^{3+}$, $Er^{3+}$, and $Yb^{3+}$ were incorporated. (A.G.W.)

**43819** THERMODYNAMICS OF DILUTE SOLUTIONS OF PLUTONIUM IN LIQUID MAGNESIUM. Johnson, Irving; Knighton, James B.; Steunenberg, Robert K. (Argonne National Lab., Ill.). Trans. Met. Soc. AIME, 236: 1242-6(Sept. 1966).

The activity coefficient of Pu in liquid Mg at 650 to 800°C, was obtained from measurements of the distribution of Pu between a 50 mole % $MgCl_2$−30 mole % NaCl−20 mole % KCl molten-salt mixture and liquid Zn−Mg alloys. For dilute solutions (0.08 at % Pu) the activity coefficient of Pu was found to vary from 10.1 to 650°C to 12.2 at 800°C. The activity coefficients of Pu in dilute liquid solutions of Pu in U, Ag, La, Ce, and Ca were estimated to be: $\gamma_{Pu(U)} = 2.8$ (1190°C), $\gamma_{Pu(Ag)} = 0.18$ (1225°C), $\gamma_{Pu(La)} = 6.7$ (1230°C), $\gamma_{Pu(Ce)} = 5.3$ (1225°C), and $\gamma_{Pu(Ca)} = 2100$ (1150°C). The distribution data indicate a value of about 0.1 at 800°C for the activity coefficient of $PuCl_3$ dissolved in the above ternary salt mixture. (auth)

**43820** ELECTROTRANSPORT OF CARBON, NITROGEN, AND OXYGEN IN THORIUM. Peterson, D. T.; Schmidt, F. A.; Verhoeven, J. D. (Iowa State Univ., Ames). Trans. Met. Soc. AIME, 236: 1311-15(Sept. 1966).

The velocity of migration of these solutes in Th metal owing to high-amperage d-c currents was measured at several temperatures. All three solutes migrated in the same direction as the electron flow. Diffusion coefficients were combined with the migration velocities to predict the steady-state concentration profile. Electrotransport was shown to be an effective method of removing C, $O_2$, and $N_2$ from Th and resistance ratios several times larger than for crystal bar Th were achieved. However, the maximum attained purification was well below the predicted values, apparently due to some form of contamination. (auth)

**43821** QUALIFICATION STANDARD FOR WELDING AND BRAZING PROCEDURES, WELDERS, BRAZERS, AND WELDING AND BRAZING OPERATORS. 1965 Edition. Formulated by the Boiler and Pressure Vessel Committee. ASME Boiler and Pressure Vessel Code Section IX. New York, American Society of Mechanical Engineers, 1965. 80p.

Requirements for ferrous materials, requirements for nonferrous materials, and requirements for brazing ferrous and nonferrous materials are given. Definitions, recommended administrative forms, and information on etching processes and reagents are included. (J.R.D.)

**43822** MODERN DEVELOPMENTS IN POWDER METALLURGY. VOLUME 3. DEVELOPMENT AND FUTURE PROSPECTS. Proceedings of the International Powder Metallurgy Conference Held in New York, June 14–17, 1965. Hausner, Henry H. (ed.). New York, Plenum Press, 1966. 287p. $22.50. (CONF–650631).

Also comprises Volume 21 of the series Progress in Powder Metallurgy.

A total of 21 papers is presented in three groups. One group of papers is concerned with nuclear applications. Another group of papers is concerned with cemented carbides, friction materials, thermoelectric materials, porous materials, and heavy metal materials. The third group of papers is concerned with research programs and future trends in various countries. (J.R.D.)

## Corrosion

*Refer also to abstracts 43083 and 45106.*

**43823** (AECL–2566) WEAR AND CORROSION IN WATER. Watson, R. D. (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Feb. 19, 1966. 85p. (EDI–67(Rev.)). Dep. mn. AECL $2.00.

The wear resistance of a number of different combinations of materials was investigated in water at room temperature. For journal bearing applications, it was found that the different combinations could be divided into two groups: those that wear at a constant rate; and those that wear at a continually decreasing rate. The first group covers those combinations that cannot provide a suitable surface finish on the rubbing surfaces through wear to allow the formation of a thin supporting film of fluid. The second group combinations produce fine abrasive wear and provide polished surfaces that can sustain thin films which will support all or part of the load. The wear resistance of thin stable metallic oxides was investigated. The crevice corrosion resistance of a number of compatible combinations was studied in different aqueous environments. (auth)

**43824** (ANL–6236) CREVICE-GALVANIC CORROSION OF ALUMINUM. Mori, S.; Draley, J. E.; Loess, R. E. (Argonne National Lab., Ill.). June 1966. Contract W-31-109-eng-38. 9p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

In water at 50°C, localized attack occurred on 1100 Al in the crevice formed by coupling to Cu, but not outside the crevice. More severe attack occurred where Cu deposited from a $CuSO_4$ solution onto Al alloy surfaces. Pure Al was not susceptible to this type of attack. (auth)

**43825** (BNWL–242) THE EFFECT OF OXIDATION, THERMAL CYCLING, AND IRRADIATION ON SILICON CARBIDE (SiC) COATED GRAPHITE. Jackson, J. L. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug. 1966. Contract AT(45-1)-1830. 7p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A study of several commercial SiC coatings on graphite substrates showed that the best coatings were 5 to 10 mils thick and had no sharp corners. These coatings were best applied to substrates whose thermal expansion was close to that of SiC. Good coatings with the above characteristics were affected very little by thermal cycling, oxidation, or irradiation. (auth)

**43826** (GEAP–4830) SODIUM MASS TRANSFER. XIV. STATISTICAL ANALYSIS OF 1961 TO 1964 SAMPLE WEIGHT CHANGE DATA. Jaech, J. L.; Dunn, E. L.; Stewart, K. B. (General Electric Co., Pleasanton, Calif. Vallecitos Atomic Lab.). Oct. 1965. Contract AT(04-3)-189. 44p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Statistical methods are employed to analyze weight change data of Type-316 stainless steel, $2\frac{1}{4}$ Cr–1 Mo, and 5 Cr–$\frac{1}{2}$ Mo–$\frac{1}{2}$ Ti alloy steel samples exposed to Na in six forced convection test loops constructed of various combinations of the test materials. The data collected prior to the end of December 1964 are analyzed. The data are the results of a five-run fractional replicate test plan performed on the programs test loops. This plan was devised to evaluate the effects of loop maximum temperature; $\Delta T$ in the system, and $O_2$ impurity level. In addition to the effects of the above primary test variables, the effects of velocity, exposure time, sample temperature, and sample location in the test loop were evaluated. Multiple regression methods were used to evaluate these effects. The results are presented graphically and numerically to show the effects of the test variables on sample weight change, and to provide corrosion rate prediction equations. (auth)

**43827** (GTR–19) COLUMBIUM COATING DEVELOPMENT FOR MULTI-THOUSAND HOUR ELEVATED TEMPERATURE OXIDATION PROTECTION. Priceman, S.; Reznik, B.; Sama, L. (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). Sept. 1963. Contract AT(30-1)-2883. 106p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Previously developed oxidation-resisting coatings were screened for multithousand-hour 2000°F protection potential. The Sn–Al slurry and Ti–Cr–Si vacuum pack coatings were selected for further development. Improvements in the Ti–Cr–Si coating included obviation of low-temperature pest oxidation problems and enhancement of the 2000°F protective life to the point where a >4000-hour 0 to 2000°F life was demonstrated. Detailed analyses of Ti–Cr–Si coatings employing metallographic, microhardness, weight change, x-ray-diffraction, and electron microbeam probe techniques are presented, which indicate that longer lived protection up to 10,000 hours is feasible. Improvement of the Sn–Al slurry coating was attempted by alloying additions and by the use of partially sintered porous Nb overlays but no substantial benefits were realized from these efforts. A parametric study of the relationship between a number of processing variables and oxidation life was also performed for this system. A study was made of the effect of binary additions of Zr, W, Mo, V, Ti, Ta, and C to Nb on the coatability and performance of some typical coatings (Ti–Si and Sn–Al). The results indicated that the effects of these binary additions are very subtle (or nil) and may therefore be obscured by minor processing variations. A brief evaluation of Ti–Cr–Si and Ag–Si slurry coatings is also included. (auth)

**43828** (HW–66911) FAILURE OF COEXTRUDED ZIRCALOY-2 CLAD URANIUM FUEL ELEMENTS DURING STATIC AUTOCLAVE TESTING. Maffei, H. P. (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Sept. 27, 1960. Contract AT(45-1)-1350. 5p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

An investigation of the failure led to the conclusion that rapid corrosion of the U core in one of the elements, related to defective Zircaloy cladding, quantitatively consumed all of the steam in the autoclave. An equivalent volume of $H_2$ was released by the U–steam reaction, with the result that the remaining fuel elements were exposed to a hot dry atmosphere. The Zircaloy-2 cladding of the remaining elements was then completely hydrided, leaving the hot U virtually unprotected when water was later added to the autoclave. (J.R.D.)

**43829** (LA–3582) QUARTERLY STATUS REPORT ON ADVANCED REACTOR TECHNOLOGY (ART) FOR PERIOD ENDING JULY 30, 1966. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). Aug. 1966. Contract W-7405-eng-36. 72p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Further developments in the components of the Fast Reactor Core Test Facility are described. A brief discussion of fast reactor physics is also presented. The status of the irradiation experiments in OWREX is described. Results of corrosive tests of carburized and uncarburized Ta and Nb alloys in Pu–Co–Ce molten alloys are described. (M.O.W.)

**43830** (NASA-CR-72029) ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM. Quarterly Progress Report No. 4, January 15, 1966–April 15, 1966. Harrison, R. W. (ed) (General Electric Co., Cincinnati, Ohio.

Space Power and Propulsion Section). Apr. 29, 1966. Contract NAS3-6474. 43p.

A program is being conducted to fabricate, operate, and evaluate a K corrosion test loop constructed of T-111 alloy. Topics discussed include: properties and fabrication of T-111 and Mo-TZC alloys, Li purification, T-111-to-316 stainless steel bimetallic joints, and T-111-to-Nb-1 Zr welds. (D.L.C.)

**43831** (NASA-CR-72057) ADVANCED REFRACTORY ALLOY CORROSION LOOP PROGRAM. Quarterly Progress Report No. 5, April 15, 1966–July 15, 1966. Harrison, R. W. (ed.) (General Electric Co., Cincinnati, Ohio. Space Power and Propulsion Section). July 29, 1966. Contract NAS3-6474. 35p.

A program is being conducted to fabricate, operate, and evaluate a K corrosion test loop constructed of T-111 alloy. Progress on materials procurement and on alkali metal purification and handling is summarized. (D.L.C.)

**43832** (NASA-TN-D-3546) COMPATIBILITY OF TANTALUM, COLUMBIUM, AND THEIR ALLOYS WITH HYDROGEN IN PRESENCE OF TEMPERATURE GRADIENT. Stephens, Joseph R.; Garlick, Ralph G. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Aug. 1966. 24p. CFSTI $1.00 cy, $0.50 mn.

An investigation was conducted to determine the suitability of Ta and Nb for use in a H-cooled nuclear rocket nozzle. Specimens having a temperature gradient from room temperature to approximately 3000°F were heated in a H atmosphere, held for a predetermined time, and cooled in H at rates from 25° to 1500°F per minute. Results showed that neither Ta nor Nb is compatible with H under these conditions. A brittle hydride phase usually formed upon cooling below about 200°F in that portion of the specimen which had been held above about 1500°F. H absorption and subsequent hydride formation in this part of the specimen is believed to be enhanced by removal of a surface oxide film during heating at elevated temperatures in H. Disintegration commonly accompanied formation of the hydride phase. Bend tests showed that H present in solution and as a hydride produced embrittlement and resulted in a ductile-brittle transition at room temperature for a H content as low as 2 atom % (110 and 220 ppm by weight in Ta and Nb, respectively). Results also indicated that available commercial alloys of Ta and Nb were not compatible with H under the imposed test conditions. An attempt was made to reduce the solubility of H in Ta or Nb by alloying with rhenium to increase the electron-atom ratio. Results from Ta–Re alloys indicated that at an electron-atom ratio of 5.5 (25 at.% Re), H absorption was reduced from 40.8 to 0.2 atomic percent for unalloyed and alloyed Ta, respectively. At a corresponding electron-atom ratio, a Nb–Re alloy absorbed 1.0 atomic percent H compared to 47.6 atomic percent H for unalloyed Nb. It is concluded that unalloyed Ta and Nb and their commercially available alloys are unattractive for use in H under conditions similar to those anticipated in nuclear rockets because of severe hydrogen absorption and embrittlement. (auth)

**43833** (ORNL-TM-1030) DYNAMIC CORROSION FOR THE HIGH FLUX ISOTOPE REACTOR. English, J. L.; Griess, J. C. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 43p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The results of a testing program to examine the long-term corrosion behavior of materials of interest to the High Flux Isotope Reactor (HFIR) are presented, and their significance to the operation of the HFIR is discussed. The test environment was water, adjusted to a pH of 5.0 with $HNO_3$, at 100°C and at flow rates ranging from 0.5 fpm to 81 fps. Under all flow conditions, the Al alloys corroded at low rates, 0.2 mpy at the higher velocities and less than 0.1 mpy at the lowest velocities. Contacting Al with Al, Be, Ni, types 304, 416, 420, or 17-4PH stainless steel resulted in pitting of the Al in the contact areas only. While of appreciable depth, the pits were randomly spread and should not be of major consequences in the HFIR system. Be, both by itself and in contact with other metals, was subject to light pitting attack. Pits did not exceed 13 mils in depth in tests that lasted in excess of one year. Within the velocity range of 13 to 81 fps, the average corrosion rate of Be was independent of velocity and constant at 2 mpy. One specimen of Be in contact with type 304 stainless steel developed evidence of stress-corrosion cracking. Commercial-grade Ni underwent shallow pitting attack and corroded at an average rate of 2 mpy. An electroless Ni deposit on 6061 Al corroded at the high rate of 19 mpy. Electrolyzed coatings (a proprietary process for coating materials with Cr) on stainless steel exhibited excellent corrosion resistance and good adherence to the stainless steel. Similar deposits flaked and peeled from Al surfaces. Hardened type 416 stainless steel was subject to blistering while type 420 stainless steel underwent stress-corrosion cracking. Delrin, a polyformaldehyde plastic considered as a gasket, material, suffered near-complete degradation after a short time in test. (auth)

**43834** (ORNL-TM-1612) CORROSION OF CARBON AND ALLOY STEELS IN WATER AND SEAWATER. Reed, S. A. (Oak Ridge National Lab., Tenn.). Oct. 1966. Contract W-7405-eng-26. 20p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Current knowledge of the factors that govern the corrosion and the service life of steel in sea water evaporation environments is summarized. Some data from OSW research and development reports are included. It is concluded that information currently available is inadequate to provide any reliable estimate of the life expectancy of carbon steel in sea water evaporator environments. Additional testing is necessary at lower dissolved oxygen levels to determine more precisely the role of oxygen in the corrosion of steel in hot sea water and brine. (25 references.) (A.G.W.)

**43835** (RISO-91) THE COMPATIBILITY OF SAP 930 WITH $UO_2$ AND UC. Lauritzen, T.; Knudsen, P.; Roerbo, K. (Danish Atomic Energy Commission, Risoe. Research Establishment). Nov. 1965. 32p. Dep. mn. Danish Atomic Energy Commission, Risoe, Denmark.

The compatibility of SAP 930 with $UO_2$ and UC was investigated at 450 to 600°C. The results indicate that a severe reaction occurs between SAP 930 and $UO_2$ within 8000 hours at 600°C, a slight reaction at 600°C for 1000 hours and after 11,900 hours at 525°C, and no reaction in 14,300 hours at 450°C. Of the three grades of UC tested (hot pressed, arc cast, cold pressed and sintered), the slightly substoichiometric, hot-pressed UC is judged to be least compatible with SAP 930, reaction occurring after 7300 hours at 450°C. No reaction was observed between SAP 930 and the other carbides at this temperature. All SAP–UC combinations are incompatible at 600°C for as little as 100 hours of heat treatment. Tests designed to study the effect of a diffusion barrier on the SAP–UC reaction have shown that anodized SAP 930 and the three uranium carbides are fully compatible at 450 and 525°C for at least 14,300 hours. Mechanical breakdown of the barrier within 8000 hours, however, limits the application of anodized SAP 930 at 600°C. X-ray diffraction analyses of the reaction products formed in each material combination tested show that the primary constituent is the intermetallic compound $UAl_3$. A second phase, visible at the SAP/reaction-product interface, has been identified as $UAl_4$ on the basis of its observed anisotropy and its position in the reaction zone. (auth)

**43836** (TID-17070) TIN–ALUMINUM COATINGS FOR THE ELEVATED TEMPERATURE OXIDATION PROTECTION OF COLUMBIUM AND COLUMBIUM BASE ALLOYS. Priceman, S.; Sama, L. (General Telephone and Electronics Labs., Inc., Bayside, N. Y.). Oct. 1962. Contract AT(30-1)-2883. 92p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Tin-aluminum base coatings of various compositions, with and without additions of Cr, Ti, Zn, Si, Nb, and Ta, were applied to Nb and Nb-base alloys by hot dripping, calorizing plus hot dipping, and by cold spraying plus vacuum diffusion. The relationship of process time and temperature to coating thickness was determined for each process. The effect of many parameters such as coating thickness, composition, stress, thermal cycling, contamination level of the base metal, and preoxidation treatments on the oxidation life at various temperatures from 1100 to 2500°F was also determined for these coatings. The results indicate present capabilities of 2000-hour protection at 2000°F for the coating system with good reason to believe that 10,000-hour protection at 2000°F is feasible. Detailed analyses of many coated samples in the as-coated and in various oxidized conditions, performed by metallography, x-ray diffraction, and electron microbeam probe techniques are also presented. In addition the general mechanism by which the Sn−Al coatings confer oxidation protection to Nb is proposed. (auth)

**43837** (TIM-823) COLUMBIUM-1 ZIRCONIUM ALLOY LITHIUM CORROSION LOOP TESTS, LCCBK-5, 6, 7, 8, AND 9. Bourdon, P. A.; Lymperes, C. J.; Schenck, G. F. (Pratt and Whitney Aircraft, Middletown, Conn. Connecticut Advanced Nuclear Engineering Lab.). Oct. 19, 1965. Contract AT(30-1)-2789. 28p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Five Nb−1 Zr alloy corrosion loops were operated with 2000°F/1000°F Li in He-filled chambers. Two loops (LCCBK-7 and 8) completed scheduled 1000-hour tests while a third loop (LCCBK-5) was stopped after 948 hours of a schedule 1000 hours because an electrical pass-through failed. The remaining two loops of this series (LCCBK-6 and 9) completed scheduled 5000-hour tests. Three loops (LCCBK-5, 8, and 9) were protected against oxidation from trace impurities in the test environment by three overlapping layers of Ta foil wrapped on the loop tubing. Loops LCCBK-6 and 7 were protected by a CANEL-developed, Al−Sn coating PWK-1. Post-test examination revealed that three of the loops (LCCBK-6, 7 and 8) had completed testing without incidence of alkali metal penetration. Metallographic examination showed that both remaining loops (LCCBK-5 and 9) had lost small amounts of Li through intergranular penetration of areas where localized oxygen contamination had occurred. Detailed chemical analysis and metallographic examination showed similar total oxygen contamination of both Ta foil wrapped and PWK-1 coated loops, more intense localized zones of oxygen contamination in the Ta foil-wrapped loops corresponding to the edges of the foil and the location of some tack welds, negligible transport of Zr from maximum temperature regions, and minor grain boundary soluting in the 2000°F regions of the 5000-hour loop. The results showed that when contamination of the Nb−1 Zr alloy by $O_2$ is at a sufficiently low level the alloy has excellent long lifetime compatibility with 2000°F Li in mono-alloy, non-isothermal systems. (auth)

**43838** (TID-23319) ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. OXIDATION OF HASTELLOY X. (Aerojet-General Nucleonics, San Ramon, Calif.). Mar. 1965. Contract AT(10-1)-880. 26p. (AN-AGCR-814). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The oxidation properties of low- and high-cobalt content Hastelloy X when exposed to air at 1750°F were studied using a continuous weight-change recording apparatus. Samples of 1.9% and 0.07% Co Hastelloy X tubing were exposed simultaneously for 5456 hours. Oxidation rate constants (k), diffusion constants (A), and apparent activation energies (Q) were calculated from the experimental data. It was found that the low-cobalt Hastelloy X exhibited a higher scaling rate when thermal cycled and a higher weight gain per unit surface area than the high-cobalt specimens. The oxidation attack in the high-cobalt specimens was elongated and predominantly intergranular, while the attack in the low-cobalt specimens was predominantly the laminar type characteristic of scaling. (auth)

**43839** EFFECT OF CHLOROFLUOROMETHANES ON GRAPHITE OXIDATION. Pallmer, P. G. (Battelle-Northwest, Richland, Wash.). Contract AT(45-1)-1830. Carbon, 4: 145-53(July 1966).

The effect of dichlorodifluoromethane, $CCl_2F_2$ and chlorotrifluoromethane, $CClF_3$, on the air oxidation of nuclear graphite was studied by the continuous measurement of weight loss. One-half volume per cent $CCl_2F_2$ in air reduced the rate of oxidation of CSF and TSGBF nuclear graphites to about one third the rate in air, whereas $CClF_3$ had negligible effect. The slight effect of $CClF_3$ is presumed to be related to its greater stability in a surface pyrolysis reaction. The adsorption of chlorine in the pyrolysis reaction can reduce the active sites available for oxidation. Surface pitting was suppressed during inhibited oxidation and greater BET area was developed than during air oxidation. It is proposed that some impurities react with $CCl_2F_2$ to become more effective oxidation catalysts. These impurities, especially vanadium, were present in significant amounts in EGCR graphite. Its oxidation behavior, as a result, showed a lower activation energy and higher rates as the impurities reacted with the halomethanes, unless or until the particular impurities were removed as volatile halides. (auth)

**43840** HIGH-TEMPERATURE OXIDATION. III. ZIRCONIUM AND HAFNIUM DIBORIDES. Berkowitz-Mattuck, Joan B. (Arthur D. Little, Inc., Cambridge, Mass.). J. Electrochem. Soc., 113: 908-14(Sept. 1966).

The oxidation of zone melted specimens of $ZrB_2$ and $HfB_2$ was studied at 1200 to 2000°K and at $O_2$ partial pressures of 1 to 700 torr in He. Parabolic rate behavior was observed. For $ZrB_2$ above 1400°K an activation energy of 77 ± 5 kcal/mole was determined. Below 1400°K the activation energy is much lower, and the mechanism of oxidation is different, probably because of the presence of $B_2O_3$ in the condensed phase. Below 1300°K, the parabolic rate constant appears to be directly proportional to $O_2$ partial pressure; at 1830°K, the rate constant is independent of $O_2$ pressure. For $HfB_2$ in the range 1480 to 1870°K an activation energy of 47 ± 4 kcal/mole was observed. Around 1970°K, the transition temperature for the monoclinic to tetragonal phase change in $HfO_2$, there is a sharp increase in the rate of oxidation. The parabolic rate constant for total $O_2$ consumption increases as the 0.4 ± 0.1 power of the $O_2$ partial pressure at 1630 and 1760°K. (auth)

**43841** KINETICS OF OXIDATION OF URANIUM BETWEEN 300 AND 625 DEG C. Baker, L. Jr.; Bingle, J. D. (Argonne National Lab., Ill.). J. Nucl. Mater., 20: 11-21(July 1966).

Studies of the isothermal oxidation of U at 300 to 625°C were carried out in a metal heat sink reaction cell designed to minimize self-heating. Data with two sources of pure U as well as 1 at. % Cu and 1 at. % Al alloys of U showed substantially identical self-accelerating reaction rates up to 400°C. Oxidation with pure U and the Cu alloy underwent a transition to a slower reaction in which the oxide was somewhat protective above 500°C, with the Cu alloy considerably more protective than the pure metal. The self-accelerating reaction continued to higher temperatures for the Al alloy. The results of isothermal oxidation studies for the β-quenched pure U metal were expressed in the form of empirical equations. From 300 to 450°C the oxidation rate was found to be proportional to $(\text{time})^{5/4}$ while above 450°C a decelerating rate proportional to $(\text{time})^{3/4}$ holds. There is evidence linking this change in the reaction kinetics at 450°C with a changed character of the oxide. (auth)

**43842** OXIDATION RESISTANT STRUCTURAL METALS FOR HIGH TEMPERATURE APPLICATIONS. Machlin, Irving; Gilmore, Charles M. (Dept. of Navy, Washington, D. C.). Metal Progr., 90: No. 3, 101-4(Sept. 1966).

A review of research on structural materials for use in oxidizing atmospheres above 1800°F is presented. Progress is reported on coated Ni and Co alloys, clad refractory metals, Cr-base alloys, Hf−Ta alloys, and Fe−Cr−Al alloys. (J.R.D.)

**43843** WEAR IN A NUCLEAR REACTOR OF NOVEL DESIGN. de Gee, A. W. J. (Metaalinstituut TNO, Delft, Netherlands). Metalen, 20: 186-92(June 1965). (In Dutch).

The wear of sintered Al powder (SAP) under conditions of vibrational contact against SAP, and of SAP against stainless steel was studied at 400°C in terphenyl coolant. The wear of SAP was much greater than that of stainless steel against stainless steel. Torsional vibration caused considerable fretting corrosion. The wear of SbTe alloys (Te 2.5, 5.0, 40.0%) compared favorably with that of steel against steel in experiments lasting 400 hr in terphenyl at 400°C. (J.R.D.)

## Fabrication

*Refer also to abstracts 43810 and 43984.*

**43844** (AAEC-TM-315) THE FABRICATION OF $^{233}$U/ALUMINIUM FUEL PLATES FOR A SUB-CRITICAL ASSEMBLY. Bardsley, J.; Ridal, A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr. 1966. 20p. Dep. mn.

One kg of $^{233}$U (as oxides) was fabricated into 205 Al-clad fuel plates. Each plate contained five wafers consisting of a dispersion of $UO_3$ and $U_3O_8$ in Al. The technique involved mixing of $UO_3$ and $U_3O_8$ and Al powders, pressing the wafers in a steel die, loading them five at a time into an Al picture frame, radiographic inspection for uniformity, edge welding, decontamination, leak-testing, sealing of leaks, and final decontamination. Maximum permissible radiation doses to hands and bodies of operators were not exceeded. The major problem was contamination of weld zones from fine $UO_3$ and $U_3O_8$. (auth)

**43845** (AD-637573) MACROLAMINATE PARTICLE COMPOSITE MATERIAL DEVELOPMENT. Summary Report, June 1, 1965–July 1, 1966. Simpson, F. H. (Boeing Co., Seattle, Wash.). Contract NOw 65-0403-d. 73p. CFSTI $3.00 cy, $0.75 mn.

Ni$-$Al$_2$O$_3$ was used as a model system to demonstrate the validity of the Knapp-Shanley concept for combining ductile and brittle materials into composites exhibiting stress relief capability not obtainable in the brittle material alone while achieving improved specific strength and stiffness characteristics not available in the metal. Ni$-$Al$_2$O$_3$ composites having 3 times the specific strength and 1.5 times the specific stiffness of Ni and impact strength 3 to 5 times that of $Al_2O_3$ were produced. These composites retained from 60 to 90% of their strength when water quenched from 2000°F; $Al_2O_3$ cracked and had no strength retention after the same quenching. At 2000°F the Ni has essentially zero strength while Ni$-$Al$_2$O$_3$ composites maintained a flexural yield strength in excess of 20 ksi. The effects of laminate particle shape on the properties of a Ni$-$Al$_2$O$_3$ composite were determined and the properties compared with those of Ni$-$Al$_2$O$_3$ cermets of the same composition. Higher strength was achieved in the cermet, but better shock resistance was obtained from laminate particle composites. Oxidation and diffusion studies indicated no diffusion between Ni and $Al_2O_3$ laminae in neutral atmospheres but formation of Ni$-$Al$_2$O$_3$ spinel occurred at their interface in oxidizing atmospheres. The oxidation resistance of Ni$-$Al$_2$O$_3$ laminate particle composites is highly dependent on porosity and orientation of laminae in relation to the exterior surface. High density reduces $O_2$ diffusion at the Ni$-$Al$_2$O$_3$ interface and limits oxidation to the specimen surface, where NiO forms. Techniques for coating laminate particles with Ni were developed to produce composites with a continuous metal matrix. This resulted in improved shock resistance and increased ductility needed in practical materials for structural applications. Substitution of higher strength Ni alloys for pure Ni produced significant improvements in the properties of the composite. Flexural strength of 32 ksi at 2000°F and 16 ksi at 2400°F were obtained in a $(Ni \cdot 2ThO_2)$ 13Cr$-$Al$_2$O$_3$ laminate particle composite. This composite gained 2 mg/cm$^2$ and 8 mg/cm$^2$ after 100 hour exposure at 2000 and 2400°F, respectively, which is 1/5 that of TD Ni. The potential of $(Ni \cdot 2ThO_2)$ Cr$-$Al$_2$O$_3$ laminate particle composites is discussed and recommendations are made for further development required to achieve the full potential of the system. (auth)

**43846** (ANL-7127) IMPROVEMENTS IN CONSOLIDATION AND FABRICATION OF VANADIUM-20 w/o TITANIUM (TV-20). Burt, W. R. Jr.; Kramer, W. C.; Karasek, F. J.; Mayfield, R. M. (Argonne National Lab., Ill.). May 1966. Contract W-31-109-eng-38. 33p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Improvements in consolidation and fabrication techniques for V$-$20 wt % Ti are presented. Major emphasis is placed on tubing fabrication with significant progress having been made in tube-blank extrusion, tube reducing, and drawing. A newly designed and built three-roll tube-reducing machine shows much promise. Use of a plastic base coat in conjunction with the drawing lubricant allowed carbide draw dies to replace aluminum$-$bronze dies, with subsequent improvement in dimensional control. Commercial efforts in drawing V$-$20 wt % Ti tube-blanks furnished by ANL were highly successful. (auth)

**43847** (BDX-613-85) RADIUS GENERATION IN VIBRATORY DEBURRING. Robbins, G. V. (Bendix Corp., Kansas City, Mo.). Sept. 1966. Contract AT(29-1)-613. 37p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Radius generation in vibratory deburring processes may be determined from a series of graphs representing radius generation versus running time. Graphs were constructed for four representative part base metals and a variety of machine-media combinations, from which maximum allowable running time may be accurately predicted in accordance with radius specifications. By comparison of metal hardness and resistance to abrasion characteristics, the graphic method may be extended to other part materials. The method, through reduction of trial and inspection, has resulted in significant savings in time and reduction of scrap. (auth)

**43848** (BNWL-269, pp 5.1-36) DEVELOPMENT OF ADVANCED FUEL CONCEPTS. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

Development of welding techniques for refractory metals is discussed. Production of $UO_2$ and $PuO_2$ spheres by agglomeration is described. Methods of production of cermet extrusion billets are summarized. A program to determine the physical properties of $UO_2$-stainless steel cermets was initiated. Pressure measurements of $UO_2$ at high temperatures are reported. Experiments to improve the strength and ductility of compacted W powders are reported. Fiber-reinforced metal-matrix composites were investigated along with W fiber reinforced Ni composites, whisker reinforced metal matrix composites, and randomly oriented fiber-metal composites. (J.R.D )

**43849** (BNWL-273(Vol.1 and App.) COMPARATIVE COSTS OF OXIDE FUEL ELEMENTS. VOLUME I AND APPENDIX. THE COMPUTED COSTS OF FUEL ELEMENTS (VIBRATIONAL COMPACTED OR PELLET) ENRICHED WITH $^{235}$U OR LOW EXPOSURE PLUTONIUM OR HIGH EXPOSURE PLUTONIUM. Burnham, J. B.; Merker, L. G.; Deonigi, D. E. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). July 1966. Contract AT(45-1)-1830. 107p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Volume I and Appendix are issued separately, but cataloged as a unit.

Computed fuel fabrication costs are given for both vibrational-compaction and pelleting fuel plants which would individually fabricate 1 ton per day of a reference oxide fuel element enriched with $^{235}$U or low-exposure (1000 Mwd/mt) or high-exposure (24,000 Mwd/mt) Pu. The operation of both types of fuel plants and the computational model are described, and the results are compared with earlier studies. A computer printout from the Fuel Element Fabrication Code is included as an appendix. (D.L.C.)

**43850** (CONF-660524-15) PRODUCTION OF THORIUM OXIDE FOR VIBRATORY COMPACTION BY A MODIFIED SOL-GEL PROCESS. Robertson, W. J.; Smith, W. J. S.; Sublett, T. H. 14p. Dep. mn. CFSTI $1.00 cy, $0.50 mn. ORAU. Gmelin, AED-CONF-66-104-8.

From 2nd International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn.

Conversion of light thoria produced by thermal denitration of thorium nitrate to dense thoria by the sol-gel process is described. (J.R.D.)

**43851** (EURAEC-1671) METHODS FOR MANUFACTURING PRESSURE VESSELS. Quarterly Report No. 15, October 1, 1965–June 30, 1966. (Neratoom, N. V., The Hague (Netherlands)). Contract 069-61-12RDN. 22p. (EUR-2863). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Work Performed under United States–Euratom Joint Research and Development Program.

The last A6-4 seam was by gas arc welded under $CO_2$, welded with an alloyed basic slag-forming wire. Testing of the A6-4 welds is described. (J.M.J.)

**43852** (EURAEC-1685) STAINLESS STEEL CLADDING OF HEAVY GAGE STEELS. Special Report No. 1. (Soudometal, S. A., Brussels (Belgium). Ghent Rijksuniversiteit (Belgium). Neratoom, N. V., The Hague (Netherlands)). [1965]. Contract 008-63-12TEEB. 12p. (EUR-2872). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Work Performed under United States–Euratom Joint Research and Development Program.

A study was made of the tape-submerged arc method for cladding steel with stainless steel. The effects of welding parameters on the properties of 1- and 2-layer claddings were studied for various tape sizes and 100-mm-thick steel plate. The measurements included geometrical dilution, chemical analysis of deposits, microhardness, mechanical tests, x-ray diffraction, and electron microanalysis. It is concluded that austeno-martensitic structures must be avoided in the first layer. (D.L.C.)

**43853** (GEAP-5008) SINTERING STUDIES AND PHASE CHARACTERIZATION IN THE SYSTEM $Eu_2O_3$–$UO_2$. Hill, H. W.; Lewis, J. E.; Grossman, L. N. (General Electric Co., Pleasanton, Calif. Vallecitos Atomic Lab.). Jan. 1966. Contract AT(04-3)-189. 30p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The sintering behavior of $Eu_2O_3$–$UO_2$ compositions containing 0 to 10 wt % $Eu_2O_3$ was studied in hydrogen atmospheres at 1550, 1650, and 1750°C. It was found that $Eu_2O_3$ inhibits densification in the binary oxide system; inhibition is most pronounced at the lower temperatures. At 1750°C, densities above 95% of theoretical were attained. X-ray-fluorescence techniques were employed for the analysis of compositional uniformity in the sintered specimens. The sintered samples were characterized for phase structure by x-ray-diffraction techniques; only the fluorite phase was detected. Phase equilibria in the $Eu_2O_3$–$UO_2$ system were determined by high-temperature thermal analysis and x-ray diffraction on specimens containing between 0 and 56.6 wt % $Eu_2O_3$. A partial phase diagram is given. The lattice parameter of the fluorite phase decreases linearly from 5.4707 Å for pure $UO_2$ to 5.400 Å for 57.5 mole % $EuO_{1.5}$. (auth)

**43854** (HW-66431) PLUTONIUM: STEAM OXIDATION AND OXIDE DISSOLUTION. Smith, R. C. (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). Aug. 12, 1960. Contract AT(45-1)-1350. 9p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A method of oxidizing Pu metal scrap and skulls using steam in inert atmosphere at 200 to 500°C is described. The method is safe, produces stable, easily stored powder, and eliminates pyrophoric hazards of handling, storage, and dissolution of metallic Pu. (J.R.D.)

**43855** (LA-DC-6954) COATED PARTICLE FUEL ELEMENTS FOR UHTREX. Bard, R. J.; Taub, J. M. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1965]. Contract W-7405-eng-36. 20p. (CONF-661003-6). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From AIME Nuclear Metallurgy Symposium on High Temperature Nuclear Fuels, Delevan, Wis.

The Ultra High Temperature Reactor Experiment (UHTREX) utilizes a He-cooled, graphite-moderated reactor to be operated at a thermal power of 3 Mw. Fuel elements are required for the start-up and early operation that will permit check-out of this high-temperature (2400°F), high-pressure (500 psi) reactor and evaluation of its operational characteristics with minimum contamination of the entire reactor system. The initial fuel elements for UHTREX contain coated $UC_2$ particles in a graphite matrix. These fuel particles have triplex (three-layer) pyrocarbon coatings. Fabrication methods, materials, and dimensions are given. (J.M.J.)

**43856** (NASA-TM-X-53453(Vol.2)) THE FABRICATION OF BERYLLIUM ALLOYS. VOLUME II. FORMING TECHNIQUES FOR BERYLLIUM ALLOYS. Williams, R. F.; Ingels, S. E. (National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center). July 1966. 84p.

The forming techniques investigated and developed for the fabrication of Be aerospace vehicle structures are documented. Time-temperature relations are established for the forming of straight bends, compound curved channels, and hemispherical segments. The flow of the material is determined, and the resulting dimensional changes are measured. The feasibility of the extreme forming of cross-rolled Be sheet material is demonstrated. (auth)

**43857** (NASA-TM-X-53453(Vol.4)) FABRICATION OF BERYLLIUM. VOL. IV. SURFACE TREATMENTS FOR BERYLLIUM ALLOYS. Williams, R. F.; Ingels, S. E. (National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center). July 1966. 16p.

The surface treatment techniques developed for use in the fabrication of Be aerospace vehicle structures are documented. Proven techniques for the removal of surface contaminants resulting from in-process shop handling, and specific pre-cleaning and activation procedures for the preparation of the surface for subsequent operations such as plating and brazing, are reported. (auth)

**43858** (NASA-TM-X-53453(Vol.5)) FABRICATION OF BERYLLIUM. VOLUME V. THERMAL TREATMENTS FOR BERYLLIUM ALLOYS. Williams, R. F.; Ingels, S. E. (National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center). July 1966. 55p.

The thermal treatment techniques investigated and evaluated for possible application in the fabrication of Be aerospace vehicle structures are documented. The effects of time and temperature on the removal of residual stresses, induced by prior work, are evaluated. The physical, mechanical, and dimensional changes resulting from varying rates of rapid cooling are reported; and the effects of prolonged exposures at high temperatures on the mechanical properties of Be sheets are investigated. (auth)

**43859** (NASA-TM-X-53453(Vol.6)) THE FABRICATION OF BERYLLIUM. VOLUME VI. JOINING TECHNIQUES FOR BERYLLIUM ALLOYS. Williams, R. F.; Ingels, S. E. (National Aeronautics and Space Administration, Huntsville, Ala. George C. Marshall Space Flight Center). July 1966. 235p.

The joining techniques investigated and developed for the fabrication of Be aerospace vehicle structures are documented. The feasibility of utilizing high-strength mechanical fasteners, including Huckbolts and Jo-bolts, adhesive bonding, and a combination of adhesive bonding and mechanical fasteners for the fabrication of Be structures was investigated. Preliminary evaluations of brazing and diffusion bonding, as assembly methods, also were made. Although each of these assembly methods is appropriate for specific applications, the primary objective of this investigation was the development of basic parameters for the assembly of Be components with mechanical fasteners. The results of this evaluation indicate that all of the investigated methods are feasible, and that large Be structures can be successfully fabricated if the details of the joint geometry and of the installation processes are carefully observed. High efficiency mechanical joints can be successfully fabricated on a routine production basis. (auth)

**43860** (SGAE-CH-35/1966) FABRICATION METHODS AND EVALUATION OF URANIUM–THORIUM–CARBIDE FUEL FOR HIGH TEMPERATURE GAS COOLED REACTORS. Koss, P.; Bildstein, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf). [1966]. 31p. (SGAE-M-5/1966; CONF-660524-12). Dep.

From 2nd International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn.

A discussion is presented of the development work carried out on the preparation and reprocessing of coated fuel particles for HTGR. The paraffin and resin processes used in the production of kernels are described. Equipment and processes for coating the particles with pyrocarbon are discussed. The testing and evaluation methods include surface contamination determination and broken particle detection by chlorination. (D.L.C.)

**43861** (TID-12860) PRESSURE BONDING OF HOLLOW THORIUM CORES IN ALUMINUM CANS. Meyer, E. (Sylcor Div., Sylvania Electric Products Inc., Bayside, N. Y.). Mar. 3, 1961. Contract AT(30-1)-1293. 9p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The main process steps are described including component cleaning, tooling and preparation, pressing, breaking, and slug finishing. (J.R.D.)

**43862** (TID-23312) FABRICATION OF ZIRCALOY-4 CLAD ZIRCONIUM–2.5 NIOBIUM PRESSURE TUBING. Reports 1, 2 and 3. Baker, James L. (Chase Brass and Copper Co., Inc., Waterbury, Conn.). [1966]. Contract AT(38-1)-412. 21p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Work was performed on both short-trial and full-size billets to establish the feasibility of fabricating Zircaloy-4-clad Zr–2.5% Nb pressure tubing, using the extrusion and cold drawing process. The billets, produced by electron beam welding a Zircaloy-4 sleeve to the OD of Zr–2.5% Nb billets, were extruded to produce duplex shells with a metallurgical bond between the two alloys. An intermediate OD grinding was performed to reduce the nonuniformity in the clad, and measurements of the clad thickness were made. (D.L.C.)

**43863** (Y-1290) HOT PRESSING TECHNIQUES FOR BERYLLIUM OXIDE. McLaughlin, L. M. (Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant). Dec. 3, 1959. Contract W-7405-eng-26. 34p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Procedures are presented for hot pressing relatively large circular wafers from various grades of beryllium oxide. The results of 61 hot-press runs are given, and techniques of mold assembly and handling are described. (auth)

**43864** (Y-1550) MACHINABILITY OF SOME INFREQUENTLY USED MATERIALS. Hurst, J. S. (Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant). Sept. 21, 1966. Contract W-7405-eng-26. 24p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A compilation of methods which have been used for the successful machining of twenty-four material types which are infrequently encountered on a production basis is presented. Methods reflect the craftsman's empirical determinations rather than an exhaustive study of the subject, since the variability of engineering materials precludes an absolute machining procedure unless large quantities of data over long runs are available. However, the data presented can serve either as enabling information for the one-of-a-kind job, or as the starting point for additional research. (auth)

**43865** (EURFNR-96F) SINTERING OF (U,Pu)$O_2$ PELLETS. Dean, G.; Pelou, C.; Beugnies, D. (Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). Translation of report CEA-R-2737. 33p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Work Performed under United States–Euratom Fast Reactor Exchange Program.

Results of sintering of $UO_2-PuO_2$ solid solutions are presented. Two processes are described: the first one is the standard process involving mechanically mixed oxides $PuO_2$ and sinterable $UO_2$, whereas in the second one direct mixtures of $UO_3$ or $U_3O_8$ and $PuO_2$ are pressed and sintered. For the two processes, sintering is carried out in flowing pure or dilute hydrogen at a temperature of 1650°C for four hours. In both cases, the (U,Pu)$O_2$ pellets have the same general characteristics ($PuO_2 \approx 20\%$): a bulk density between 96 and 99% of the theoretical density, a single phase product with grains of about 10 to 20 $\mu$, an oxygen-to-metal ratio varying between 2.00 and 1.95 according to the moisture content of the sintering atmosphere. (auth)

**43866** APPLICATION OF AUTORADIOGRAPHY FOR CONTROL OF IRREGULARITY OF ACTINIDE ELEMENT LAYERS. Kazakevich, A. T.; Surin, V. M. At. Energ. (USSR), 21: 132-4(Aug. 1966). (In Russian).

Autoradiographic data on irregularities of $\alpha$-active, $1 \times 10^3$ to $4.1 \times 10^6$ fission/min cm$^3$, layers of $^{238}$U, $^{238}$Pu, $^{239}$Pu, and $^{241}$Am on plane metal backings prepared by electrochemical and drop methods are tabulated. It is shown that the electrochemical method produced a more uniformly distributed coating in comparison to the drop evaporation method. (R.V.J.)

**43867** THE PRESSING AND SINTERING PROPERTIES OF MOLYBDENUM POWDERS. Domsa, A. Bul. Stiint. Politeh. Cluj, No. 7, 213-20(1964). (In Rumanian).

Tests were made with molybdenum powders obtained from indigenous raw materials with favorable granulometric characteristics and satisfactory purity (99.47% Mo). The processes of pressing and sintering were studied. It was established that a pressure of 3 to 5 tf/cm$^2$ is advantageous, that presintering at 1,100°C in an atmosphere of hydrogen for a duration of 90 minutes leads to an increased density, the porosity however remaining high. A final sintering at 2,100°C has favorable effects. The resistance to bending and the resistance of the pressed edges were also studied. (auth)

**43868** FLUIDIZED-BED PROCESSING OF PARTICULATE NUCLEAR FUELS. Blocher, J. M. Jr.; Broning, M. F.; Oxley, J. H. (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. Progr., Symp. Ser. Pt. 15, 62: 64-78 (1966).

Reactions of interest in particulate fuel processing are reviewed and current practice in the United States and several foreign countries is outlined. Problems peculiar to the process are discussed. A mechanism of soot formation and distribution in pyrolytic carbon coatings is proposed. (auth)

**43869** INFLUENCE OF FABRICATION PARAMETERS ON THE QUALITY OF PLUTONIUM–IRON FUEL ELEMENTS. Van Asbroeck, Ph. (Centre d'Etude de l'Energie Nucleaire, Mol, Belg.). Energ. Nucl. (Milan), 13: 371-80 (July 1966). (In French).

The possibilities for the use of Pu in the enrichment of fuel elements are briefly reviewed. The method of fabrication of Pu-containing fuel elements developed by the CEN-Mol group is described. The method is based on the densification of ceramic powders using sonic vibration. The powder to be compacted is composed of a mixture of three granulometric fractions (large, average, and fine), of which one fraction at least contained Pu. These fuel elements, composed of a fissionable ceramic core and of a nonfissionable cladding should correspond with specifications on the distribution of Pu and density. The methods used to measure the distribution, the type of distribution, and the dependence of the distribution on various fabrication variables are examined. The distribution is particularly dependent on the degree of mixing of the fine fractions, on the dimensions and form of the various granulometers, and the mode of filling the fuel elements. The speed of filling and the duration of packing of the powder forming the core had a smaller effect. (tr-auth)

**43870** CONTINUOUS GAMMA-RAY CONTROL OF HOT ROLLED INGOTS BEFORE CUTTING. **Holzhey, J.; Becker, E.; Wagner, F.-W. (Forschungsinstitut fuer NE-Metalle, Freiberg i. B. Technische Hochschule Otto von Guericke, Magdeburg, Ger.). Isotopenpraxis, 2: 9-14(Jan. 1966). (In German).**

According to the literature data, transmission control tests by $^{60}$Co gamma radiation with scanning rates of about 200 m/s make possible the detection of material flaws of a size of 5 to 10% of the ingot thickness. This accuracy did not seem to be sufficient for successfully testing the hot ingots before cutting them in the roll mill. The results of the studies carried through to improve the resolving power are described. The properties and features of the technique used are illustrated by the results of special experiments. Flaws of 2% of relative size were detectable when the flaw sizes were specified in fractions of the ingot thickness. The maximum scanning rate amounted to about 45 mm/s for 1.8 Ci of the $^{60}$Co source activity. The samples of 500 mm in length had a square cross section of 135 × 135 mm or 185 × 185 mm, respectively. (auth)

**43871** EXPERIMENTAL PRODUCTION OF METALLIC URANIUM AND THORIUM AT THE INSTITUTE OF ATOMIC ENERGY. **Souza Santos, Tharcisio D.; Haydt, Heliton M.; Trench de Freitas, Clauer (Instituto de Energia Atomica, Sao Paulo, Brazil). Met., ABM (Ass. Brasil. Metais), 21: 147-52(Feb. 1965). (In Portuguese). (IEA-89).**

The research of the laboratory of the Division of Nuclear Metallurgy, Institute of Atomic Energy, regarding the production of metallic U and Th, the melting and making of ingots of U under vacuum, and processing by powder metallurgy of Th sponge obtained is reviewed. After justification of the process adopted under existing conditions in Brazil, the characteristics of materials employed are analyzed, and the equipment and metallurgical operations involved in U and Th production are described. The U-melting and ingot-making operations in the Wild-Barfield electric furnace under a vacuum of $10^{-4}$ mm Hg and the processing by powder metallurgy of Th are also described. (tr-auth)

**43872** FABRICATION OF UO$_2$ FUEL ELEMENTS FOR THE RE-SUCO SUBCRITICAL ASSEMBLY. **Souza Santos, Tharcisio D.; Haydt, Heliton M.; Trench de Freitas, Clauer (Instituto de Energia Atomica, Sao Paulo, Brazil). Met., ABM (Ass. Brasil. Metais), 21: 217-22(Mar. 1965). (In Portuguese). (IEA-92).**

Fabrication is described of fuel elements for the subcritical assembly re-suco utilizing pellets of UO$_2$ with 40.2 ± 0.1 mm of dia clad by 1100 Al alloy tubes of 44.00 ± 0.2 mm outside dia and 40.5 ± 0.2 mm of inside dia; the pellets occupy a total height of 950 mm inside each tube, having a total length of 1.309 mm. The subcritical assembly is to be used for the studies of the reactor physics and will utilize a total of 313 fuel elements each one containing 23 pellets of 330.4 g of UO$_2$, with a density of 6.6 ± 0.1 g/cm$^3$. The fabrication processes starting with ammonium diuranate calcination are described. (J.R.D.)

**43873** CONTRIBUTION ON THE PLASMA TECHNOLOGY OF TUNGSTEN. **Kirner, K. (Robert Bosch GmbH, Stuttgart). Metall, 20: 708-11(July 1966). (In German).**

The meaning of plasma was explained and the utilization of high plasma temperatures for the working and processing of W, the metal with the highest melting point, was described. The methods used, coating, welding, forging, plasma injection, and the cylindrical melting of particles were described; the growth of W single crystals was considered. (tr-auth)

**43874** OXIDE FUELS: HOW U. K. WILL FILL THE NEED. **Franklin, N. L. (United Kingdom Atomic Energy Authority, Risley, Eng.); Avery, D. G.; Heal, T. J. Nucleonics, 24: No. 9, 64-5; 72(Sept. 1966).**

The production of enriched UO$_2$ reactor fuel for the UK second power program, which will require 300 tons of enriched oxide in 1970 and amounts sharply increasing thereafter, is considered. A $400 million expansion is foreseen to meet this need. The program for the fuel production, oxide fuel manufacture, reprocessing the spent oxide, and economic prospects are covered. (J.F.P.)

**43875** PLUTONIUM: RESERVED FOR FAST REACTORS. **Franklin, N. L.; Kehoe, R. B. (United Kingdom Atomic Energy Authority, Risley, Eng.). Nucleonics, 24: No. 9, 66-71(Sept. 1966).**

The use of Pu as reactor fuel in the United Kingdom is discussed. It is considered that the multi-ton amounts of Pu that will be available during the 1970's is better used to provide core loadings for the first commercial fast breeders than as an alternate fuel for thermal reactor stations. Pu production, fueling of the AGR, use in fast breeders, system analysis, logistics and value, and thermal reactor burning are covered. (J.F.P.)

**43876** INVESTIGATIONS ON THE OBTAINING OF SPHERICAL URANIUM DICARBIDE PARTICLES FROM URANIUM DIOXIDE. **Kalinowski, Bohdan; Mucha, Franciszek; Wlodarski, Rafal (Inst. of Nuclear Research, Warsaw). Nukleonika, 11: 327-38(1966). (In Polish).**

The preparation of UC$_2$ in the form of dense spherical particles is described. The applied method is based on heating UO$_2$ particles in a graphite powder bed in a furnace with a graphite heating element up to 2500°C, in Ar atmosphere under normal pressure. Starting materials such as UO$_2$ prepared by sintering, unsintered UO$_2$ and UO$_2$ agglomerated without additions containing C substances are used. The influence of the UO$_2$ on the particle size distribution and the product quality is examined. The dependence of free C content and product density on the spherical particles specific surface (diameter) of the product is established and explained. Some of the problems are discussed concerning the increase of the process scale. (auth)

**43877** PROBLEMS OF PROTECTIVE COATINGS FOR REFRACTORY MATERIALS. **Bueckle, H. Tech. Mod., 57: No. 5, 51-9(May 1965). (In French).**

Although there are to-day over 60 industrial methods for protecting Nb and Mo alloys, none of them meets the safety requirements for vital components of airborne machines. Since all these protection problems have been circumvented by means of alternative solutions (artificial cooling) the utility of employing protective coatings would appear to have fallen seriously into discredit. Modern projects concerning "space gliders" should restore full importance to the problem of protection owing to the need to protect plating in Nb, Mo, Ta or W alloys by thin and highly heat-emissive coatings. The data of the new problem call for fundamental recasting of the methods of conventional solutions right from the project stage, which must be founded on analysis of the operating conditions of each individual mission. A brief "working diagram" is described, whose various factors and correlations are commented upon. (auth)

**43878** VARIATIONS IN SOME PROPERTIES OF SINTERED TUNGSTEN CARBIDE–COBALT ALLOYS WITH PARTICLE SIZE AND BINDER COMPOSITION. **Suzuki, Hisashi (Tokyo Univ.). Trans. Jap. Inst. Metals, 7: 112-17(Apr. 1966).**

The properties of WC-10% Co alloys were examined. It was found that the determination of the mean particle size by the coercive force method appears to be erroneous. Both hardness and electric resistivity of the alloys were found to decrease with increasing C content and grain size. The strength of the alloys reaches a maximum value at a definite point of the two-phase region depending on the binder composition and grain size. The lattice parameter of the binder phase and the magnetic saturation of the alloys are independent of grain size, however, the stability of the low-C alloys at high temperatures is strongly affected by grain size. (auth)

**43879** FABRICATION OF A COLUMBIUM ALLOY LIQUID METAL LOOP. Kearns, W. H.; Young, W. R.; Redden, T. K. (General Electric Co., Evendale, Ohio). Weld. J. (N. Y.), 45: 730-9(Sept. 1966).

Electrical power generating systems employing alkali metals as working fluids at temperatures up to 2200°F are being considered for space applications. To study boiling and condensing of Na and K in such systems at 1800 to 2200°F, a Nb-alloy pumped loop was constructed for operation in a large vacuum environmental chamber. The loop was designed to accept approximately 100 kw of energy from electric heaters and measured approximately 2½ by 6 by 8 ft high. Alloy pipe and bar stock of Nb-1% Zr were procured to specifications for the loop components. Gas W-arc welding procedures were developed for joining the parts in a He atmosphere in a vacuum purged chamber and in a gas purged plastic enclosure. Postweld heat treating techniques were established to prevent weld aging embrittlement in service. Stainless steel-to-Nb brazed joints connect the loop to the liquid metal reservoir and to pressure sensing devices. The individual components and three loop subassemblies were welded in a He-filled chamber. These subassemblies were field welded to form the completed loop structure. All welded joints were He leak checked and either radiographed or inspected ultrasonically for soundness. The loop has operated with no major difficulties over 5000 hr above 800°F and more than 3000 hr between 1500 and 2200°F using Na and K as a working fluid. (auth)

**43880** FIZIKA METALLICHESKIKH PLENOK. (Physics of Metal Coatings). Respublikanskii Mezhvedomstvennyi Sbornik, Seriya Metallofizika. Kiev, Izdatel'stvo Naukova Dumka, 1965. 130p.

Ten articles are included on the structure and physical properties of thin foil coatings; the preparation of thin coatings in a vacuum and by cathode sputtering in a gas discharge; the ductility and coercive forces of Permalloy coatings; properties of Ti, Zr, and Hf films coated by the thermodissociation (iodide) method; and preparation of Pt and Au foils and measurements of their thickness. (R.V.J.)

**43881** FLUIDIZED BED DEPOSITION OF AN OXIDATION-RESISTANT COATING. Pike, E. Grant (Pfaudler Co., Rochester, N. Y.). 17p. (CONF-660210-3). ORAU. Gmelin, AED-CONF-66-006-5.

From American Inst. of Chemical Engineers 58th National Meeting, Dallas.

The fluidized bed process was experimentally evaluated as a means of depositing an oxidation-resistant coating on Nb alloys, particularly D-43. Some preliminary values are given for the necessary chemical and process parameters. The following values were obtained from screening experiments: usable bed height, that portion greater than 3 in. above the gas distribution plate and below the unexpanded bed height; HCl flow rate, greater than 65.3 g/hr; silicon concentration, in excess of 15 wt % retards deposition; coating thickness, directly proportional to deposition time. Further experiments will be required to produce the best process conditions. (B.L.M.)

## Properties and Structure

*See also* **CHEMISTRY — Inorganic and Physical Chemistry**
**PHYSICS — Solid State Physics**

*Refer also to abstract 45106.*

**43882** (AD-636487) AN ELECTRON TRANSMISSION STUDY OF OXIDE PARTICLE STATISTICS IN TD-NICKEL ALLOY. Inman, M. C.; Smith, P. J. (Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics). June 1966. 39p. (AFOSR-66-1111). CFSTI $2.00 cy, $0.50 mn.

Electron microscope studies of the substructure of Ni strengthened by dispersed $ThO_2$ particles were continued. Special attention was paid to the problem of the stability of a strenthening dispersion in terms of particle size distribution and agglomeration with respect to environmental temperatures ranging to the melting point (1450°C) of Ni matrix. Electron microscope dark field techniques were also employed to investigate the crystal structure of individual particles in the above temperature range. Finally, the bulk strength (in terms of microhardness) as a function of time at various temperatures was interpreted in the light of the substructural observations. (auth)

**43883** (AD-637777) HEAT TREATMENT AND MECHANICAL PROPERTIES OF A URANIUM-2 PERCENT Mo-2 PERCENT Zr-2 PERCENT Nb-0.5 PERCENT Ti ALLOY. Myers, Michael; Edelman, Ralph E. (Frankford Arsenal, Philadelphia, Pa.). July 1966. 7p. (M-67-1-1). CFSTI $1.00 cy, $0.50 mn.

A study was made of a U−2% Mo−2% Zr−2% Nb−0.5% Ti alloy in the rolled and forged conditions. It was found that, in the as-worked condition, this alloy possessed little or no ductility. However, in the solution-treated and aged condition, it did possess a measurable amount (1 to 3% elongation) of ductility. (auth)

**43884** (AGN-8191(Vol.1)) ALKALI METALS EVALUATION PROGRAM. THE LATENT HEAT OF VAPORIZATION AND VAPOR PRESSURE OF SODIUM. Achener, P. Y.; Jouthas, J. T. (Aerojet-General Nucleonics, San Ramon, Calif.). July 1966. Contract AT(04-3)-368. 37p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The investigations reported herein determined the latent heat of vaporization of sodium and measured the vapor pressure of this liquid metal at temperatures up to 1700°F. The experimental method developed for the latent heat determination included a technique of double measurements which permitted the analytical elimination of the heat transfer between the boiler and the guard heater. Pressurized argon cover gas was used to control the boiling temperature, to protect the liquid metal from oxidation, and to provide the means for transferring the liquid metal condensate from the volumeter to the boiler. The equation proposed for the latent heat of vaporization of sodium from 1100°F to 1700°F is: $h_{fg} = 2023 - 0.2129T$ (Btu/lb); where T is in °F. (auth)

**43885** (ASRL-TR-132-2) EFFECT OF TUNGSTEN COMPOSITION ON THE MECHANICAL PROPERTIES OF THE W-Ni-Fe HEAVY ALLOY. O'Neil, Joseph W.; Salyer, Phillip N. (Massachusetts Inst. of Tech., Cambridge). Dec. 1965. Contract AF 49(638)-1463. 33p. (AFOSR-66-1670).

The ductility and strength of W−Ni−Fe composites over a wide range of vol % W was investigated at room temperatures. A series of composites was prepared (40% W to 95% W), sintered in the presence of the liquid phase and tested in tension. The sources of strength and ductility of the W−Ni−Fe composite was determined as related to the measured dihedral angle, mean particle dia, W mean free path, W contiguity and vol % W. Similar stress-strain curves were obtained for all specimens tested which showed liquid phase sintered microstructure. These test results indicate that the vol % has very little effect upon the composite strength. For W−Ni−Fe composites where the W mean free path is greater than the measured particle dia (approximately 85% to 96% W), the maximum strain and maximum stress at necking dropped off rapidly. (auth)

**43886** (BBC-111) DEVELOPMENT OF INTERMETALLIC COMPOUNDS FOR VERY HIGH TEMPERATURE APPLICATIONS. Quarterly Progress Report, April 1-June 30, 1961. Owens, L.; Paine, R. M.; Stonehouse, A. J.; Beaver, W. W. (Brush Beryllium Co., Cleveland, Ohio. Research and Development Dept.). Aug. 1, 1961. Contract AT(33-3)-20. 37p. Dep. mn. CFSTI $2.00 cy. $0.50 mn.

Studies of the intermediate-temperature properties of beryllides were continued in an effort to explain the following previously observed effects: low modulus of rupture between 1000 and 2000°F, lower thermal resistance when measured at 1600 than at 2500°F, tendency to spall after slow cooldown from 1600°F, and tendency to oxidize relatively rapidly when soaked at 1300 to 1800°F. No accelerated oxidation was found over the temperature range 800 to 2200°F for $TaBe_{12}$, $Ta_2Be_{17}$, $MoBe_{12}$, $TiBe_{12}$, or $WBe_{12}$. The effects appear to be limited to the zirconium beryllides and, to a lesser extent, to the niobium beryllides. Tests using various atmospheres showed that intermediate-temperature effects were greatly enhanced by, if not limited to, an oxidizing atmosphere. Moisture is of secondary importance. Results so far from studies of effects of impurities indicate that addition of Fe to $ZrBe_{13}$ improves its intermediate-temperature properties. A possible explanation of the underlying cause and mechanism for the observed effects is discussed. (A.G.W.)

**43887** (BNWL-231) IMPROVED POSTIRRADIATION STRESS-RUPTURE PROPERTIES OF HASTELLOY X-280. Levy, I. S. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). July 1966. Contract AT(45-1)-1830. 12p. Dep. mn. CFSTI $1.00 cy, $0.50 mm.

Stress-rupture specimens of Hastelloy X-280, a solution-hardenable nickel-base alloy, were given various experimental preirradiation thermomechanical treatments. The specimens were subsequently irradiated at 540°F to exposures of approximately $1 \times 10^{20}$ nvt (E > 1 Mev) and $3 \times 10^{20}$ nvt thermal. When compared to a standard treatment, some experimental treatments increased postirradiation rupture life up to 106%, with no change in postirradiation minimum creep rate. These treatments increased duration of postirradiation secondary creep up to 115% and increased the duration of postirradiation tertiary creep up to 107%. Property improvements are interpreted based on the interaction of the microstructures formed by the preirradiation treatments with the neutron environment and subsequent thermal and stress environments associated with the testing. Relationships of these results to reactor material fabrication are considered. (auth)

**43888** (BNWL-290(Pt.1)) THE EFFECTS OF AGING ON DISSIMILAR METAL WELDED JOINTS WITH MULTI-PASS WELDING OF HASTELLOY X AND HASTELLOY W FILLER METAL. Ireland, D. R. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). July 1966. Contract AT(45-1)-1830. 47p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The effect of aging for 500, 1000, and 5000 hr at 1000, 1200, 1400, and 1600°F on the mechanical properties of Hastelloy X weld metal, Hastelloy W weld metal, Hastelloy X-280 base metal, and Haynes 25 base metal were evaluated. Results of bend tests, tensile tests, hardness tests, and metallographic examinations of unaged material and materials aged 500 and 1000 hr are presented. Both weld metals age-embrittle with exposure to temperatures of 1000 to 1600°F, but, on the basis of information to date, Hastelloy W appears to be better suited to prolonged exposure to these temperatures than Hastelloy X weld metal. Hastelloy X-280 maintains a ductility of 40% or more when aged and tested at all four aging temperatures, while Haynes 25 maintains a ductility of 18%. (A.G.W.)

**43889** (CONF-660606-39) LIQUID Pu: A REVIEW OF ITS UNUSUAL PROPERTIES. Ofte, D.; Rohr, W. G.; Wittenberg, L. J. (Mound Lab., Miamisburg, Ohio). [1965]. Contract AT-33-1-GEN-53. 8p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From American Nuclear Society Meeting, Denver, Colo.

Density and viscosity measurements made on liquid Pu and its alloys are reported. It was found that liquid Pu has a viscosity of 6.0 centipoise at 640°C. Additionally density measurements of liquid Pu indicated a 2.4% volume increase during transformation from the liquid to the solid state. The viscosity-composition relation in Pu-Fe showed a viscosity maximum of 25 centipoise, an extremely high value for a liquid alloy at the 9.5 at. % Fe eutectic composition and temperature, 410°C. High viscosity values were also noted for Pu-Ce-Co alloys with eutectic temperatures near 450°C. For all systems studied, the viscosity of Pu was found to increase with initial solute additions. (P.C.H.)

**43890** (COO-1198-385) X-RAY DIFFRACTION STUDY OF ATOMIC ORDERING IN TWO SIGMA PHASES. Spor, R. W.; Claus, H.; Beck, Paul A. (Illinois Univ., Urbana). Aug. 11, 1966. Contract AT(11-1)-1198. 18p. (CONF-660814-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 15th Annual Conference on Applications of X-Ray Analysis, Denver, Colo.

The structure and ordering of sigma phases formed by transition metal alloys are discussed. An experimental study was made of the ordering in the sigma phases of Cr-Re and Fe-Re alloys. The results, compared with those of previous studies, show that ordering in (Fe-Re)$\sigma$ corresponds to the usual arrangement (the larger X atoms tend to occupy the high coordination number sites), while inverse ordering is found for (Cr-Re)$\sigma$ owing to the inverse size relationship ($V_X/V_Y < 1$). (D.L.C.)

**43891** (EURAEC-1686) THE AUSTENITISATION OF PM 24 STEEL. Special Report No. 15. (Chantiers de l'Atlantique Penhoet-Loire, Paris (France)). Apr. 19, 1966. Contract 054-61-12RDF. 16p. (EUR-2873). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Work Performed under United States-Euratom Joint Research and Development Program.

Results of the investigation indicate that austenitization at 900°C leads to refining of the grain (for rates between 2 and 1000°C/min) whatever the cooling rate after super-heating. However, if specimens cooled slowly after super-heating are reheated to 1000°C, it is found that some super-heated grain zones are regenerated at 900°C (no refining is found). No appreciable modification of the ferritic structure after cooling at 5°C/min from 900°C was found. The regeneration of PM.24 steel after super-heating leads to a homogeneous fine grained steel. (J.R.D.)

**43892** (IITRI-578-P27-20) YIELD PHENOMENA AND FRACTURE OF HYDRIDED ZIRCONIUM. Quarterly Report, April 1-June 30, 1966. (IIT Research Inst., Chicago, Ill.). Aug. 15, 1966. Contract AT(11-1)-578. 35p. (IITRI-B6035-20; EURAEC-1707). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Work Performed under United States-Euratom Joint Research and Development Program.

The relationships between yield point and strain-hardening coefficient of high-purity polycrystalline Zr (0.005 to 0.009 mm average grain diameter) with temperature (-200° to +200°C) were investigated. The yield point consistently appeared with increasing temperature, provided that the grain size was favorable. The results accentuated the first-order importance of fine grain size in yield point occurrence. Also, the smaller grain size was accompanied by a lower strain-hardening coefficient. For each grain size, however, the strain-hardening coefficient was statistically constant with varying temperature. The effects of temperature were explained on the basis of the viscous behavior of grain boundaries relative to grain size. By means of dynamic transmission electron microscopy, dislocation behavior was observed in relatively fine-grained (~0.005 mm) and coarse-grained (~0.008 mm) materials air-cooled from the final annealing temperature. Considerably less dislocation generation, mobility, and interactions were found resulting from strain in the fine-grained material. The results supported the mobile dislocation concept (Johnston-Hahn model) for the yield point phenomenology. The lower strain-hardening coefficient accompanying smaller grain size was a manifestation of these same structural effects. (auth)

**43893** (KAPL-3119) DUCTILE-TO-BRITTLE TRANSITION OF NIOBIUM-VANADIUM ALLOYS AS

AFFECTED BY NOTCHES, STRAIN RATE, NITROGEN, AND OXYGEN. Calhoun, C. D. (Knolls Atomic Power Lab., Schenectady, N. Y.). Apr. 1965. Contract W-31-109-eng-52. 35p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The ductile-to-brittle transition temperatures of niobium – vanadium alloys of 2, 4, 6, and 8 wt % vanadium were investigated in the temperature range of –253 to 100°C. Notched tensile-testing was the testing method used. The transition temperature, arbitrarily defined as that temperature where the reduction in area was 35%, was increased by the addition of vanadium to niobium – the relationship being linear up to 6 wt % vanadium. The temperature range over which the alloys changed from ductile to brittle behavior varied directly with vanadium content. When tested in the unnotched condition, these alloys did not undergo a ductile-to-brittle transition as defined in this study, nor did they become notch-sensitive at temperatures of –196°C. Notched specimens were tested at cross-head motions of 0.025 and 2.0 in./min to study the strain-rate sensitivity of niobium – vanadium alloys. Most of the data indicated that the mechanical properties of niobium – vanadium were insensitive to strain rate. The addition of 500-ppM nitrogen and 1500-ppM oxygen to niobium –2 and –4 wt % vanadium alloys caused pronounced increases in the ductile-to-brittle transition temperature of the niobium – vanadium. Nitrogen was found to be more potent than oxygen as a strengthener. The influence of both nitrogen and oxygen on the mechanical properties was greater in the alloys of higher vanadium content. In a study of the microstructure adjacent to the fracture surface, light microscopy indicated that the propagation of a crack in the alloys studied progressed transgranularly. Electron fractographs of selected specimens revealed that the predominant mode of failure was cleavage. (auth)

**43894** (KAPL–3146) DUCTILE-TO-BRITTLE TRANSITION OF NIOBIUM VANADIUM ALLOYS WITH SMALL RATIOS OF SPECIMEN DIAMETER TO GRAIN DIAMETER. Calhoun, C. D. (Knolls Atomic Power Lab., Schenectady, N. Y.). Aug. 1965. Contract W-31-109-eng-52. 26p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Tensile specimens of niobium – 4 wt % vanadium (Nb$_4$V) and niobium – 6 wt % vanadium (Nb6V), having one, three, and five grain boundaries across the gauge section, were tested in the temperature range that encompassed their ductile-to-brittle transition temperatures. The effects of a variation in grain size, vanadium content, and specimen size on the ductile-to-brittle transition temperature were studied. The properties of the alloys in these tests were compared with those of a fine-grained material (~ 35μ opposed to 487 to 2030μ) studied in earlier tests. Decreasing the number of grain boundaries across the gauge section of niobium – vanadium tensile specimens from 5 to 1 did not have a large effect on the tensile properties. The transition temperature was increased about 55C by increasing the vanadium content from 4 to 6 wt %. A limited number of tests indicated that the ductile-to-brittle transition temperature was lowered by a decrease in specimen size. The microstructure adjacent to the fracture surface was studied with light microscopy, which indicated that cracks propagated in a transgranular manner. Selected electron fractographs revealed that the predominant mode of failure was cleavage. To determine the correct heat treatments for the desired grain sizes in the tensile specimens, the relationships between grain size and 1-hr anneals were determined for swaged rod of Nb4V and Nb6V. (auth)

**43895** (LA-DC–7934) STABILITY OF DELTA-PHASE PLUTONIUM–GALLIUM ALLOYS. Miner, W. N. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1966]. Contract W-7409-eng-36. 23p. (CONF-660551–1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 7th Semiannual Meeting of the Plutonium Weapons Information, Livermore, Calif.

A summary is presented concerning a program in which 90 specimens of Pu containing from 0.1 to 1 wt % Ga were subjected to a variety of conditions and several thermal treatments at –194 to +100°C. Density measurements were used as an index to phase stability along with dilatometry, metallography, and chemical analysis. Conclusions concerning parameters of delta-phase stability in these alloys are included. (J.R.D.)

**43896** (LA-DC–8163) THERMAL CONDUCTIVITY OF ZTA GRAPHITE. Wagner, P.; Dauelsberg, L. B. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1966]. Contract W-7405-eng-36. 20p. (CONF-661013–1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 6th Conference on Thermal Conductivity, Wright-Patterson AFB, Ohio.

Measurements of the thermal conductivity of ZTA graphite in the temperature interval 23°C to 2700°C are reported. Three different methods were used to cover the temperature interval. The conductivity perpendicular to the direction of the applied hot-working force is reported to be k (watt/cm-°C) = 460/T(°K) + 0.28 over the entire temperature interval. The thermal conductivity in the parallel direction is discussed. Measurements of linear thermal expansion are reported and changes of dimension which occur during the progress of these measurements are discussed. (auth)

**43897** (MSAR–66–174) EFFECTS OF HIGH TEMPERATURE SODIUM ON AUSTENITIC AND FERRITIC STEELS. TOPICAL REPORT NO. 7. DESIGN PROPERTIES OF ONE HEAT OF 2 1/4 Cr–1 Mo STEEL AND 316 STAINLESS STEEL IN HIGH TEMPERATURE AIR, HELIUM AND SODIUM ENVIRONMENTS. Andrews, R. C.; Kirschler, L. H. (MSA Research Corp., Evans City, Pa.). Sept. 14, 1966. Contract AT(11-1)-765. 78p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Results are presented from tests of the mechanical properties of steels exposed to air, He, high-oxygen Na, low-oxygen Na, and Na with a continuous C source at 1100°F. In the case of $2\frac{1}{4}$ Cr – 1 Mo steel, both the thermal aging during the He tests and the decarburization during the Na tests appeared to weaken the material after prolonged exposures. The contamination of the Na with O$_2$ appeared to accelerate this weakening by increasing the rate of decarburization. The most critical effects, upon exposure to 1100°F Na, were noted in the decrease of both rupture strength and creep strength. Results with 316 stainless-steel indicated that thermal aging weakened the material slightly after prolonged exposures. The extreme levels of carburization obtained during the high-C creep-rupture tests embrittled the material to a point where there was almost a complete loss of ductility. Concurrent with this loss of ductility, there was an increase in both rupture and creep strength. (A.G.W.)

**43898** (NAA-SR-Memo–11967) CALCULATION OF WEIGHT GAIN IN GAS-METAL REACTIONS. Young, W. A. (Atomics International, Canoga Park, Calif.). June 14, 1966. Contract AT(11-1)-Gen-8. 42p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A computer program is described for calculation of the change in weight of a metal as a consequence of reaction with a gas such that a product film is formed; the reaction need not occur under isothermal conditions. The program is written in FORTRAN IV for use with IBM-7090/7094 or systems 360 computers. The output consists of tabulated weight gain versus time and temperature and, if desired, graphic display (SC-4020 equipment) of weight versus time, temperature versus time, and/or weight versus temperature. (auth)

**43899** (NASA-TN-D-3610) STRUCTURE AND PROPERTIES OF TUNGSTEN-BASE POWDER METALLURGY COMPOSITES. Herbell, Thomas P.; Weeton, John W.; Quatinetz, Max (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Sept. 1966. 51p. CFSTI $2.50 cy, $0.50 mn.

Tungsten and W-base billets were prepared and extruded in order to determine the strengths of composites produced by promising powder metallurgy methods and to relate microstructure and other metallurgical parameters to these strengths. Two different types of W-base composite powders were utilized. One (tungsten–5 vol % of either $HfO_2$, $ZrO_2$, or $ThO_2$; and W–0.5 wt % Zr) was prepared by the reduction of mixed oxides derived from the chemical solution and calcination of metallic salts. The other (W–0.5 wt % Zr) was prepared by the mechanical comminution of an arc-melted ingot. Both of these basic powder types as well as various combinations with Ta powder were studied. Most of the materials exhibited 3000°F tensile and stress-rupture strengths that greatly exceeded those of unalloyed W. Stress-rupture tests at 3500°F also indicated an appreciable strength advantage relative to W. Strengthening occurred despite the fact that a uniform distribution of dispersoids was generally not achieved. Improved high-temperature properties were attributed in most cases to the combined effects of dispersoids and solid solution alloying. Materials showing particular promise were W–5 vol % $HfO_2$, and W–0.5 wt % Zr plus 5 to 15 wt % Ta. W–0.5 wt % Zr plus 5 wt % Ta was prepared with a two-phase structure. This material possessed good high-temperature strength properties (twice those of unalloyed W) and was easy to extrude. The strengthening was attributed to the presence of a two-phase structure (one W rich, one Ta rich) combined with a uniform distribution of fine dispersoids. Presumably the presence of Ta-rich phase aided in the extrusion of this material. (auth)

**43900** (NBS-D-150) A FUNDAMENTAL STUDY OF CERAMIC MATERIALS FOR NUCLEAR REACTOR APPLICATIONS. Summary Report, July 1, 1961–June 30, 1962. Parker, H. S.; Hasko, S.; Schreyer, C. H.; Foster, H. J. (National Bureau of Standards, Washington, D. C.). Contract AT(49-2)-1165. 87p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Results of x-ray-diffraction analysis and metallographic examination of powder mixtures such as $UO_2-Y_2O_3-Al_2O_3$, $UO_2-Y_2O_3-ZrO_2$, and $UO_2-Y_2O_3-La_2O_3$ at room temperature and after heating to 1800°C in air are reported. The O/U ratios of specimens of $UO_{2+x}:3Y_2O_3$ after various heat treatments are also reported along with x-ray-diffraction results for $UO_2-Y_2O_3$ mixtures at $\frac{1}{4}$ to 5 mole % $UO_2$. (J.R.D.)

**43901** (NBS-D-154) A FUNDAMENTAL STUDY OF CERAMIC MATERIALS FOR NUCLEAR REACTOR APPLICATIONS. Summary Report, July 1, 1962–June 30, 1963. Hasko, S.; Schreyer, C. H.; Parker, H. S. (National Bureau of Standards, Washington, D. C.). Contract AT(49-2)-1165. 61p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Oxide mixtures for nuclear reactor applications were studied. The three major areas of interest were phase equilibria, application of sols, and vaporization and equilibrium strudies. The equilibrium phase relationships in air were investigated in the $Y_2O_3-ZrO_2$ and the $UO_2-UO_3-Y_2O_3-ZrO_2$ systems. The former was studied using both powders and sols as starting materials in the entire compositional range at isotherms of 1200, 1400, 1800, and 2000°C. In the quaternary system the emphasis was on mixtures including end members in the plane $UO_{2+x}:3Y_2O_3-UO_{2+x}:3ZrO_2$. These were studied by means of x-ray-diffraction and chemical analysis ($U^{+4}$, $U^{+6}$, O/U ratio, and U content) following selected heat treatments. In the application of sols, studies are in progress on thoria, urania, yttria, and zirconia. Utilizing the mass spectrometer, efforts were made to observe the vapor species above $UO_{2+x}:3Y_2O_3$, $UO_2$, $Y_2O_3$, and $ZrO_2$. (J.R.D.)

**43902** (NMI-7018) THORIA DISPERSION IN URANIUM. Anderson, R. W. (Nuclear Metals, Inc., West Concord, Mass.). Mar. 25, 1963. Contract AT(30-1)-1565. 16p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

In dispersion tests, U was melted and heated to 800°C in contact with a $ThO_2$–Ni cermet. Particles of $ThO_2$ were found to have agglomerated and segregated in the U–Ni alloy. (J.R.D.)

**43903** (NP-16238) BIBLIOGRAPHY ON THE HIGH-TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS IN THE CONDENSED STATE. Volume 1966, Number 2. Diamond, J. J. (ed.) (National Bureau of Standards, Washington, D. C.). Apr.–June 1966. 77p. National Bureau of Standards Free.

A total of 810 references are presented on the following subjects: devices for obtaining, measuring, and controlling temperatures above 1500°C; devices for physical measurements above 1000°C; properties below and above 1000°C of materials melting above 1500°C; properties above 1000°C of materials melting below 1500°C; phase equilibria, and reactions above 1000°C. (D.L.C.)

**43904** (NUMEC-3428-23) GROWTH OF SINGLE CRYSTALS OF PLUTONIUM. Progress Report, April 1–June 30, 1966. (Nuclear Materials and Equipment Corp., Apollo, Pa.). July 20, 1966. Contract AT(30-1)-3428. 25p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Large grains of alpha 2.0 mm × 2.4 mm were grown by subjecting plutonium with an average grain size of 0.030 mm to a pressure of 25 kilobars at 350°C for 8 hours followed by cooling to room temperature under pressure. A constant-temperature oil bath to be used for growing large grains of alpha by an isothermal transformation technique was designed, constructed, tested, and installed in a glove box. (auth)

**43905** (ORNL-3212) EFFECT OF ALLOYING ELEMENTS ON THE STRENGTH, STABILITY, AND CORROSION AND OXIDATION RESISTANCE OF COLUMBIUM. A Literature Survey. Hobson, D. O. (Oak Ridge National Lab., Tenn.). Mar. 7, 1962. Contract W-7405-eng-26. 32p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Data relating the effect of additions of W, Re, Ta, Mo, Hf, V, Cr, Zr, Ti, and Al on the strength, oxidation resistance, corrosion resistance, aging characteristics, and compositional stability of Nb are compiled. All the above elements improved the strength of Nb. Generally, this is accompanied by a decrease in ductility. On the basis of strengthening and the retention of low-temperature ductility, the addition of vandium gives the best results. Oxidation resistance is obtained in Nb only when alloyed with large additions of elements that result in the formation of brittle intermetallics. It is believed that a fabricable, oxidation-resistant Nb-base alloy does not presently exist. Coatings are available, which give good oxidation resistance, but these are subject to thermal damage and chemical incompatibiltiy. Theories are presented as to the effect of alloying on the corrosion resistance of Nb in molten Li. It is noted that the corrosion of unalloyed Nb can be correlated with its $O_2$ content. Data on the aging of Nb are presented and a mechanism by which this aging might occur is described. It is concluded that a Nb–V alloy with an $O_2$-scavenging third element can produce an alloy combining the best properties of strength, ductility, corrosion resistance, and high-temperature stability. (auth)

**43906** (ORNL-P-2361) AN EFFECT OF CURING STRESSES IN EPOXY RESINS. Crouse, R. S.; Gray, R. J. (Oak Ridge National Lab., Tenn.). [1965]. Contract W-7405-eng-26. 13p. (CONF-660518-8). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From AEC Annual Metallography Meeting, Denver, Colo.

Metallographic examination of some brazed "T" joints revealed cracking when other mechanical tests indicated a sound joint. The size and location of the cracks pointed to a failure occurring during curing of the specimen mount. Several mounting procedures were tried to confirm this suspicion, and finally a sound joint was retained using epoxy resin and pelletized alumina. The addition of pelletized alumina to the epoxy resin prevented cracking by absorbing some of the curing stresses. Nickel plating also eliminates cracking but introduces other difficulties when etching. (auth)

**43907** (ORNL-TM-1596) THERMODYNAMIC FUNCTIONS OF NUCLEAR MATERIALS: UC, $UC_2$, $UO_2$, $ThO_2$, AND UN. Godfrey, T. G.; Woolley, J. A.; Leitnaker, J. M. (Oak Ridge National Lab.. Tenn.). Oct. 1966. Contract

W-7405-eng-26. 23p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The thermodynamic functions, $H^0_T - H^0_{298}$, $C^0_p$, $S^0_T$, and $(F^0_T - H^0_{298})/T$, of five compounds of nuclear interest (UC, $UC_2$, $UO_2$, $ThO_2$, and UN) were calculated from literature data and tabulated at 100° increments. Estimates of accuracy are included. The fit of the original enthalpy data to the calculated curve is shown graphically in each case. (auth)

**43908** (PWAC-237) SURVEY OF ELEVATED TEMPERATURE PROPERTIES OF COLUMBIUM. Stoloff, N. S. (Pratt and Whitney Aircraft, Middletown, Conn. Connecticut Advanced Nuclear Engineering Lab.). Jan. 15, 1958. Contract AT(30-1)-2789. 28p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A compilation is presented of data reported in the literature up to 1957 on the following elevated-temperature properties of commercially pure Nb and a Nb-0.65% Zr alloy: tensile strength, creep strength, stress rupture strength, thermal conductivity, electric resistivity, coefficient of thermal expansion, and elastic modulus. Properties are compared with those of other high-temperature alloys. (13 references). (A.G.W.)

**43909** (SC-DC-66-1888) THE EFFECT OF HYDROSTATIC PRESSURE (14 kbar) ON THE ULTIMATE COMPRESSIVE STRENGTH OF VARIOUS SINTERED MATERIALS. Cordell, Thomas L.; Corll, James A. (Sandia Corp., Albuquerque, N. Mex.). Aug. 1966. Contract AT (29-1)-789. 18p. (CONF-661102-4). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

For Presentation at American Society of Mechanical Engineers, Winter Annual Conference, New York.

The investigation of the increase in ultimate compressive strength of sintered materials as a function of hydrostatic support pressures up to 14 kbar is reported. Six WC materials and five oxide ceramics were tested. All materials displayed significant increase in axial ultimate compressive strength when radially loaded by fluid pressure. For example: the ultimate compressive strength of WC with 3% Co binder is raised from 52 kbar to 92 kbar by 14 kbar fluid support pressure. A schematic design employing this effect in the design of a high pressure apparatus is included. (auth)

**43910** (TID-23269) GROWTH AND PROPERTIES OF METAL AND COMPOUND SINGLE CRYSTALS. Final Report, June 1, 1961–June 30, 1966. Wei, C. T. (Michigan State Univ., East Lansing. Div. of Engineering Research). June 30, 1966. Contract AT(11-1)-1042. 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Laboratory equipment was fabricated and used in production of Zn single crystals with desired orientations and highly finished surfaces. LiF crystals were also produced. Subboundaries of crystals having disorientations of the order of 30 seconds of arc were detected. Studies were completed on work hardening and deformation structure in LiF single crystals. Bicrystals of Zn were produced for twinning studies. The theory of fracture was investigated by calculating the stress field at a grain boundary for 100 equally spaced slip bands containing 100 dislocations at one sign in each band. (J.R.D.)

**43911** (UCRL-6262(Pt.1)) A SELECTED BIBLIOGRAPHY [ON] PHYSICAL PROPERTIES AND PHASE DIAGRAMS OF TEN REFRACTORY OXIDES. PART I. REPORT LITERATURE. Kennedy, James; Lane, Zanier; Maynard, Glenn; Tunis, Mary Jane (Lawrence Radiation Lab., Univ. of California, Livermore). Dec. 1960. Contract W-7405-eng-48. 32p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A listing is presented of approximately 300 reports dealing with physical properties and phase diagrams for $Al_2O_3$, BeO, CaO, $CeO_2$, $Cr_2O_3$, MgO, $SnO_2$, $TiO_2$, $Y_2O_3$, and ZrO. (M.C.W.)

**43912** (UCRL-14859) STRESS INTENSITY FACTORS FOR HOLLOW CIRCUMFERENTIALLY NOTCHED ROUND BARS. Harris, David O. (Lawrence Radiation Lab., Univ. of California, Livermore). Apr. 29, 1966. Contract W-7405-eng-48. 26p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Stress intensity factors are presented for a hollow circumferentially notched round bar subjected to tension, torsion, bending, and transverse shear. These previously undetermined factors are calculated from the limiting values of stress concentration factors for a small notch root radius. The stress intensities factors obtained are compared with results obtained by other investigators, when possible, and a favorable correlation is observed. The accuracy is further indicated by the good agreement of the fracture toughness of 7075-T6 Al, determined in a series of tension and bending tests conducted on hollow notched round bars, with the corresponding value obtained by other investigators. (auth)

**43913** (UCRL-16256) APPLIED THERMODYNAMICS IN HIGH-TEMPERATURE REFRACTORIES SYSTEMS. Searcy, Alan W. (Lawrence Radiation Lab., Univ. of California, Berkeley). July 16, 1965. Contract W-7405-eng-48. 23p. (CONF-650502-5). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Electrochemical Society, San Francisco.

The mechanisms of equilibra changes in chemical and physical process with temperature change are discussed. An analogy of the activity series for generalization of high-temperature aqueous reactions is described in which the relative activities of elements with $O_2$ are considered. (J.R.D.)

**43914** (UCRL-16619) DECOMPOSITION OF CHROMIUM-TUNGSTEN SOLID SOLUTION. Porter, David (Lawrence Radiation Lab., Univ. of California, Berkeley). Jan. 1966. Contract W-7405-eng-48. 54p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Thesis.

The mechanism of solid-solution decomposition within the chemical spinodal boundary was investigated for the W-Cr system. Two alloys were solution-treated, quenched, and aged at various temperatures inside the chemical spinodal boundary. It was concluded from x-ray and metallographic evidence that W-Cr alloys do not decompose by a spinodal mechanism. The decomposition process was found to be one of nucleation and growth. A theoretical analysis provided answers that explain the behavior of this alloy system. (auth)

**43915** (UCRL-16761) DYNAMIC STRAIN AGING OF A HIGH STRENGTH STEEL. Goel, V.; Busch, R.; Zackay, V. F. (Lawrence Radiation Lab., Univ. of California, Berkeley). Mar. 1966. Contract W-7405-eng-48. 32p. (CONF-661101-1). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From American Society of Metallurgists Meeting, Cleveland.

The response of quenched and tempered and ausform H-11 steel to strain aging was investigated. The straining temperature was the most important variable. Straining at temperatures up to 900°F and retempering resulted in large increases (~30%) in yield strength without the loss in ductility associated with static strain aging. The yield-to-ultimate-strength ratio approached unity in the strain-aged steels, however, elongations of 8-12% were retained. (auth)

**43916** (UCRL-16922) STRENGTHENING MECHANISMS OF ULTRA-HIGH-STRENGTH AUSTENITIC STEEL. Fahr, Dieter (Lawrence Radiation Lab., Univ. of California, Berkeley). June 1966. Contract W-7405-eng-48. 51p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Thesis.

The development of a high-strength stable austenitic steel was investigated. A composition expected to show stabilization and dispersion strengthening as results of thermomechanical processing was selected. The principal variables investigated were the amount and temperature of deformation and the temperature of aging after deformation. The mechanical properties were most sensitive to the amount of deformation. Both strength and ductility increased with prior deformation. Within the ranges studied, the deformation and aging temperatures had a smaller effect on the properties. The stabilization of the austenite also depended on the amount of reduction. With large deformations, the $M_s$ temperature was lowered from –50°C (undeformed) to about –196°C. Optimum thermomechanical processing produced a stable austenitic steel with the following mechanical properties: 180,000 psi yield strength, 270,000 psi ultimate tensile strength, 20% elongation, and 40% reduction in area. (auth)

**43917** (USBM-RC-1113) ELECTRICAL RESISTIVITY OF FUSED HAFNIUM CARBIDE ALLOYS AT ELEVATED TEMPERATURE. Deardorff, D. K.; Copeland, M. I. (Bureau of Mines, Albany, Oreg. Albany Metallurgy Research Center). July 1964. Contract AT(11-1)-599. 20p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Electrical resistivity was determined at various temperatures up to about 1600°C for sections from high-density fused HfC–C (graphite) alloys containing 1.9, 4.6, and 6.5 weight percent free C (total C contents of 7.7, 10.4, and 12.3 weight percent). One additional test was made to 2000°C on the 6.5 weight percent graphite alloy. Respective room temperature resistivity values of 28.3, 35.0, and 42.1 microhm-cm were found. Extrapolation of these values indicated that C-saturated HfC (5.8 wt %) has a room temperature resistivity near 27 microhm-cm. Resistivity increased with temperature for these alloys, to 146, 170, and 198 microhm-cm respectively at 1500°C. (auth)

**43918** THE CRYSTAL STRUCTURE OF $LuMn_5$ AND THE $RMn_{12}$ COMPOUNDS (WHERE R = Gd, Tb, Dy, Ho, Er AND Tm). Wang, Frederick E.; Gilfrich, John V. (Naval Ordnance Lab., Silver Spring, Md.). Acta Crystallogr., 21: 476-81(Oct. 10, 1966).

By means of single-crystal and powder x-ray-diffraction methods, the crystal structures of six $RMn_{12}$ compounds (where R is a rare earth element) were shown to be isostructural with that of $ThMn_{12}$. These $RMn_{12}$ compounds were found in the following systems: Gd–Mn, Tb–Mn, Dy–Mn, Ho–Mn, Er–Mn and Tm–Mn. A hitherto unreported and unexpected compound, $LuMn_5$ ($P6_3mc$) with cell dimensions a = 5.18, c = 8.56 Å, were found in the Lu–Mn system in which the expected compound "$LuMn_{12}$" is absent. The structure of $LuMn_5$ is a variation of the C14 ($MgZn_2$ type) structure represented by $LuMn_2$. (auth)

**43919** A REFINEMENT OF THE CRYSTAL STRUCTURE OF ZINC MOLYBDENUM(IV) OXIDE, $Zn_2Mo_3O_8$. Ansell, G. B. (West Ham Regional Coll. of Tech., London); Katz, Lewis. Acta Crystallogr., 21: 482-5(Oct. 10, 1966).

Counter intensity data for $Zn_2Mo_3O_8$, were collected and a refinement of the structure was carried out. The new data are consistent with space group $P6_3mc$; cell dimensions are a = 5.759, c = 9.903 Å. The refined structure confirms the presence of triangular groups of bonded Mo ions. The O coordination scheme—octahedral (with edge sharing) around Mo ions, octahedral for half the Zn ions and tetrahedral for the other half—is also confirmed. (auth)

**43920** RARE EARTH COBALT COMPOUNDS WITH THE $A_2B_{17}$ STRUCTURE. Ostertag, Werner; Strnat, Karl J. (Wright-Patterson Air Frce Base, Ohio). Acta Crystallogr., 21: 560-5(Oct. 10, 1966).

A series of new compounds corresponding to the formula $R_2Co_{17}$ was prepared, where R represents the rare earth elements Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm and Lu. The compounds $Pr_2Co_{17}$, $Nd_2Co_{17}$, $Sm_2Co_{17}$, $Gd_2Co_{17}$ and $Tb_2Co_{17}$ are isomorphous with $Th_2Zn_{17}$ (space group $R\bar{3}m$), while $Ho_2Co_{17}$, $Er_2Co_{17}$, $Tm_2Co_{17}$ and $Lu_2Co_{17}$ were found to have the $Th_2Ni_{17}$-type structure (space group $P6_3/mmc$). The patterns of $Ce_2Co_{17}$ and $Dy_2Co_{17}$ were explained on the basis of a coexistence of the hexagonal high temperature modification and the rhombohedral low temperature modification. The volume of the formula unit $R_2Co_{17}$ decreases with increasing atomic number of the rare earth element, except for $Ce_2Co_{17}$ and $Pr_2Co_{17}$. In $Ce_2Co_{17}$, Ce appears to occur tetravalent, and in $Pr_2Co_{17}$, Pr seems to have the effective valency 3.3. (auth)

**43921** THE STRUCTURE OF $\beta$-$UO_3$. Debets, P. C. (Reactor Centrum Nederland, Petten, Netherlands). Acta Crystallogr., 21: 589-93(Oct. 10, 1966).

The structure of $\beta$-$UO_3$ was determined by means of x-ray and neutron-diffraction powder data. Ten formula units are contained in the monoclinic unit cell, which belongs to the space group $P2_1$. The structure can be regarded as consisting of layers, perpendicular to the monoclinic axis, interconnected by uranyl groups. (auth)

**43922** STRAIN-AGING IN TANTALUM. Hartley, S. (Univ. of Birmingham, Eng.). Acta Met., 14: 1237-46 (Oct. 1966).

A self-consistency theory of the rise in flow stress with aging after straining and of the yield point return is developed and applied to experimental results on unalloyed Ta. It is shown that the initial rise in yield stress obeys the relation: $\Delta\sigma/\bar{\sigma} = K_1 \times K_2t^{2/3}$ where $\Delta\sigma$ is the difference between, and $\bar{\sigma}$ the arithmetic average of the yield stress after aging and the stress at which the prestrain was terminated, $K_1$ and $K_2$ are constants for a given set of test conditions and t is the aging time. The constant $K_2$ is proportional to $D^{2/3}$, D being the diffusivity of the pinning element. This equation is derived by employing the concepts of thermally activated flow and by assuming that the only function of the pinning element is to reduce the length of mobile dislocation line produced by prestrain; the concept of breakaway is not invoked. The theory developed applies only to the early stages of aging. The theory is applied to strain-aging studies of unalloyed Ta and it is shown that the initial rise in flow stress and yield point return are controlled by the diffusion of $O_2$ to dislocations. (auth)

**43923** DISLOCATION ARRANGEMENTS IN TANTALUM SINGLE CRYSTALS DEFORMED IN TENSION AT 373 DEG K. Spitzig, W. A.; Mitchell, T. E. (Case Inst. of Tech., Cleveland). Acta Met., 14: 1311-23(Oct. 1966).

The dislocation structure in Ta single crystals deformed in tension to various strains at 373°K was investigated by transmission electron microscopy. Foils were prepared by a disc technique and various sections were analyzed at each strain. In stage I of the stress-strain curve tangles of dislocations are observed lying parallel to the slip plane; these tangles contain many straight screw dislocations and a high density of dislocation loops. In stage II the tangles tend to become linked together to form walls of dislocations approximately parallel to the slip plane. Misorientations across the walls become increasingly apparent as the crystals are deformed further into stage II and stage III. It is suggested that the walls are small-angle boundaries formed when short-range secondary slip occurs to reduce the long-range stresses at the ends of slip lines. Accordingly a high density of secondary dislocations is observed. The flow stress is found to be proportional to the square root of the total dislocation density. Dislocation reactions in bcc metals are analyzed and a quantitative theory of stage II hardening is developed based on the cell formation theory of Hirsch. (auth)

**43924** MICROSTRAIN BEHAVIOR OF BERYLLIUM SINGLE CRYSTALS. Lawley, A.; Breedis, J. F.; Meakin, J. D. (Franklin Inst., Philadelphia). Acta Met., 14: 1339-47(Oct. 1966).

The room temperature microstrain behavior of zone-refined single crystal Be was examined as a function of prestrain. Crystals oriented for basal slip were deformed in simple tension (prestrains ≤0.09) and by low-frequency cyclic compression (prestrains ≤0.40). The friction stress was determined from the energy dissipated in generating closed hysteresis loops as a function of forward plastic strain and maximum stress amplitude. The corresponding dislocation substructures were characterized by transmission electron microscopy. The friction stress $\tau_f$ associated with forward plastic strain amplitudes $\leq 5 \times 10^{-6}$ is low and in the range 0.02 – 0.13 kg $mm^{-2}$ with no significant effect of prestrain; a large fraction of $\tau_f$ is due to dislocation-impurity interaction so that the actual lattice friction stress on the basal plane is extremely small. Closed hysteresis loops exist at stress amplitudes up to the macroscopic flow stress level with corresponding forward plastic strain amplitudes as high as $2 \times 10^{-3}$. Under these conditions, a much higher friction stress $\tau_{f(2)} \sim 1$ kg $mm^{-2}$ is measured. Cyclic compression eliminates the region of easy glide (Stage I) in Be and raises the flow stress. Differences in behavior in tension and cyclic compression, and the independence of $\tau_f$ with prestrain, were related to the associated dislocation substructures. (auth)

**43925** OXIDATION AND MECHANICAL PERFORMANCE OF TUNGSTEN AT HIGH TEMPERATURES AND HIGH PRESSURES. Etemad, Galen A. (North American Aviation Inc., Downey, Calif.). AIAA (Amer. Inst. Aeronaut. Astronaut.) J., 4: 1543-8(Sept. 1966).

The results of a study where tungsten and several composite tungsten systems were exposed to heat fluxes from 1015 to 4160 Btu/ft²-sec at stagnation pressures from 21 to 70 atm and at stagnation temperatures from 5500° to 6750°R are presented. The test was conducted in the Cornell Aeronautical Laboratory wave superheater facility, where 39 specimens were tested. The variation of surface recession rate with heat-transfer coefficient was determined. Test results show that, in environments and structures where heat-transfer coefficients are less than 1.5 lb/ft²-sec and surface temperatures do not exceed 4000°R, the material is stable except for oxidation, which proceeds in a rate-controlled manner. As the surface temperature rises above 4000°R, at heat-transfer coefficients up to 2.6 lb/ft²-sec and at stagnation pressure below 50 atm, surface recession occurs by diffusion-controlled oxidation. When stagnation pressures exceed 50 atm, structural failure of the material occurs at the surface, and very high recession rates up to 0.1 in./sec are observed. (auth)

**43926** CRYSTAL STRUCTURE OF THE COMPOUND $TbAl_3$. Kripyakevich, Petro I.; Zaluckyj, Iwan I. Ann. Univ. Mariae Curie-Sklodowska, Lublin-Pol., Sect. AA, 19: 97-103(1964). (In Polish).

By means of x-ray-diffraction the crystal structure of the compound $TbAl_3$ was determined. The structure belongs to the $BaPb_3$ type (9-layered closest packing ABABCBCAC = hhchhchhc; space group $R\bar{3}m - D^5_{3d}$, 3 $Tb^{(1)}$ in 3 (a) 000, 6 $Tb^{(2)}$ in 6 (c) 00z with $z_{Tb}{}^{(2)} = 0.219$, 9 $Al^{(1)}$ in 9 (e) ½ ½ 0, 18 $Al^{(2)}$ in 18 (h) $x\bar{x}z$ with $x_{Al}{}^{(2)} = 0.188$, $z_{Al}{}^{(2)} = 0.110$); a = 6.181 ± 0.001 Å, c = 21.15 ± 0.01 Å, c/a = 3.422. (auth)

**43927** EMISSIVITY AND ELECTRICAL RESISTIVITY OF FLAME-SPRAYED $Al_2O_3$ AND $ZrO_2$ COATINGS AT HIGHER TEMPERATURES. Reiss, F. (Kernforschungszentrum, Karlsruhe, Ger.). Ber. Deut. Keram. Ges., 43: 477-8(July 1966). (In German).

Measurements of the specific electrical resistivity of flame-sprayed $Al_2O_3$ coatings at temperatures up to 1800°C, of the partial radions of sprayed $Al_2O_3$ coatings between 900 and 1650°C and of $ZrO_2$ coatings between 900 and 1350°C are described and the results given. Further points include observations on the compatibility of Ta, Mo, W, and C with $Al_2O_3$ at high temperatures and changes occurring in the coatings at high temperatures. (auth)

**43928** THERMODYNAMIC CHARACTERISTICS OF SELF-DIFFUSION IN $\alpha$-URANIUM. Cerovic, Danica; Mihajlovic, Aleksandar, Ristic, Momcilo M. Bull. Boris Kidric Inst. Nucl, Sci., 17: 147-9(Apr. 1966).

Thermodynamics of U self-diffusion activation at 450 to 500°C were calculated. Results were compared with those obtained for U self-diffusion using empirical formulas. (J.R.D.)

**43929** THE THERMAL CONDUCTIVITY OF COMPACTED POWDER CARBONS AND MIXTURES OF CARBON POWDERS WITH URANIUM CARBIDE PARTICLES. Tye, R. P.; Woodman, Margaret J. (National Physical Lab., Teddington, Eng.). Carbon, 4: 167-76(July 1966).

Measurements of thermal conductivity and electrical resistivity were undertaken over the temperature range 20°–200°C for a series of compacted graphite powder matrices and a series of matrix materials mixed with different volumes of coated uranium carbide particles. The temperature range was extended to 1000°C for particular samples. Results indicate that the manufacturing process produces homogeneous materials whose measured transport properties are affected markedly by variations of several parameters including the initial compacting pressure, the volume of added particles, and the amount of pyrolytic carbon deposited in the pores. Large variations in both physical properties are obtained at the lower temperatures for changes in each of these parameters. For the pressure variable the thermal conductivity is found to change linearly with increase of pressure over the range 6 – 1000 psi. At higher temperatures the differences are much reduced and the materials behave in a manner similar to other carbons and graphites having similar properties at the lower temperatures. (auth)

**43930** STRUCTURE AND PROPERTIES OF PYROLYTIC CARBONS PREPARED IN A FLUIDIZED BED BETWEEN 1900 DEG AND 2400 DEG C. Price, R. J.; Bokros, J. C.; Koyama, K.; Chin, J. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Contract AT(04-3)-167. Carbon, 4: 263-72(July 1966). (GA-6506).

Pyrolytic carbon deposits were produced in a fluidized bed between 1900° and 2400°C from a carrier gas containing between 1 and 15% methane. The carbons had either a granular, laminar, or isotropic microstructure. Formation of granular carbon occurred at low methane partial pressures and low bed surface areas. Increasing the deposition temperature decreased the metallographic grain size and increased the density, x-ray apparent crystallite size, and preferred orientation of the granular deposits so that at the highest temperature, the deposits took on a liminar appearance. Increasing the deposition temperature increased the crystallite size and density of the isotropic and transition deposits. The elastic moduli and fracture stresses of the carbons deposited from 3% methane rose from 1.5 to $1.8 \times 10^6$ psi and 18 to $32 \times 10^3$ psi, respectively, as the deposition temperature was increased from 1900° to 2400°C. The isotropic and transition carbons had fracture stresses of $\sim 30 \times 10^3$ psi and elastic moduli that decreased from $\sim 2.2$ to $\sim 1.6 \times 10^6$ psi over the deposition temperature range of 1900° to 2400°C. The carbons had thermal conductivities perpendicular to the deposition plane in the range of 1 to $6 \times 10^{-2}$ cal/cm sec °C. The conductivities were highest for the isotropic carbons and lowest for the most highly oriented laminar carbons. The relations between deposition conditions, structure, and properties are discussed. (auth)

**43931** THE URANIUM–URANIUM DIOXIDE SYSTEM ABOVE 1130 DEG C. Guinet, Philippe; Vaugoyeau, Henri; Blum, Pierre L. (CEN, Grenoble, France). Compt. Rend., Ser. C, 263: 17-20(July 4, 1966). (In French).

The liquidus curve was determined by a saturation method by nullifying the thermal gradient during cooling and the solidus curve was determined by analysis of the deposits in equilibrium with the liquid at each temperature. The composition of the monotectic obtained by chemical analysis is 59 mole % dioxide and the reaction temperature was found to be 2470 ± 30°C. The diagram is of the deported eutectic type. It contains a region of liquid immiscibility between 47 and 59 mole % dioxide and a range of existence of the substoichiometric compound $UO_{2-x}$ with O/U minimum ratio of 1.6 at 2470 ± 30°C. (tr-auth)

**43932** STUDY OF THE SELF DIFFUSION OF PLUTONIUM IN THE $\epsilon$ PHASE. Dupuy, Michel (CEA-CEN/FAR, Fontenay-aux-Roses, France). Compt. Rend., Ser. C, 263: 35-8(July 4, 1966). (In French).

The self-diffusion of Pu in the $\epsilon$ phase was studied. An activation energy of 18,500 cal/at. g and a frequency factor of $2.2 \times 10^{-2}$ cm$^2$ sec$^{-1}$ were deduced. The self-diffusion coefficients obey the law $D = 2.2 \times 10^{-2} \exp[(-18.5 \text{ kcal/mole})/RP]$. The results show that the Debye temperature of $\epsilon$ Pu is abnormally high and the Gibbs law is only a first approximation of a very complex correlation. (J.S.R.)

**43933** A SURFACE ASPECT PRESENTED BY ZIRCONIUM ANNEALED IN THE $\beta$ PHASE. Renucci, Louis; Langeron, Jean-Paul (Centre d'Etude de Chimie Metallurgique, Vitry-sur-Seine, France). Compt. Rend., Ser. C, 263: 39-41(July 4, 1966). (In French).

Observations were made on high-purity Van Arkel Zr annealed for 22 hr at 1070°C at pressures of $10^{-6}$ to $10^{-7}$ torr and on Kroll metal treated at pressures of $10^{-7}$ torr. There is, under these conditions, pollution of the Zr. The appearance of facets is produced when the weight concentration of oxygen in the metal either is or becomes higher than $400 \times 10^{-6}$. This phenomenon is due to an increase of the surface tension anisotropy between the different crystalline faces resulting from the presence of oxygen. (tr-auth)

**43934** THERMODYNAMIC STUDIES ON THE HYDROGEN–PALLADIUM SYSTEM. **Aston, John G. (Pennsylvania State Univ., University Park). Engelhard Ind., Tech. Bull., 7: 14-20(June-Sept. 1966).**

Results of investigations are reported concerning absorption and diffusion processes of H and D in Pd and Pd alloys at temperatures below 250°C. An activation process was developed for catalyzing the interfacial step allowing the use of volumetric methods for absorption and diffusion measurements. Data and discussions are included on Pd alloys with Ag, Sn, and Rh. (J.R.D.)

**43935** PERMEATION OF DEUTERIUM AND HYDROGEN THROUGH PALLADIUM AND 75 PALLADIUM-25 SILVER AT ELEVATED TEMPERATURES AND PRESSURES. **Rubin, Leonard R. (Engelhard Ind. Inc., Newark, N. J.). Engelhard Ind., Tech. Bull., 7: 55-62(June-Sept. 1966).**

Work was performed to allow comparison of the rates of permeation of gaseous $H_2$ and D at temperatures and pressures approximating technical usage. An alloy of Pd with 25 wt % Ag, which has substantially replaced pure Pd in the art of gas purification, was examined concurrently. Operating conditions were chosen so as to avoid complications due to the possible formation of $H_2$ or deuterium-rich second phases and the resultant hysteresis effects on permeation rates. (auth)

**43936** STRESS RELAXATION IN URANIUM. **Tsvetaev, A. A.; Bovenko, V. N.; Golovanov, Yu. N. (Inst. of Physical Chemistry, Moscow). Fiz.-Khim. Mekh. Mater., 2: 266-71(1966). (In Russian).**

Stress-relaxation in isothermally heated U and activation energy in stress relaxation at 300, 400, 450, and 500°C were studied using U specimens with $0.9 \times 10^{-3}$% Fe, $1.6 \times 10^{-3}$% Si, $1.0 \times 10^{-3}$% Al, $<2 \times 10^{-3}$% Ni, $<2.3 \times 10^{-4}$% Cu, $<3.0 \times 10^{-3}$% N, and $6 \times 10^{-2}$% C. The specimens were subjected to two-phase recrystallization and 6 hr annealing at 620°C, with drawing at room temperature and 50% compression before tempering the $\alpha$-phase at 900°C. The stress relaxation curves are presented and analyzed. (R.V.J.)

**43937** INFLUENCE OF INERT GASES ON TUNGSTEN RECRYSTALLIZATION. **Alexandrova, Yu. M.; Alexandrov, L. N.; Eliseeva, V. D. (All-Union Inst. of Scientific Research of Sources of Light, Saransk, USSR). Fiz.-Khim. Mekh. Mater., 2: 327-32(1966). (In Russian).**

Studies were made of W recrystallization in spectrally pure Ar and Kr (at $1.5 \times 10^{-5}$ atm $O_2$) and in vacuum. Annealing in the inert gas medium improved the mechanical and physical properties of W, increased its strength at temperatures up to 3000°K, and stabilized fine grain structure delaying the appearance of coarse grains. The recrystallization temperature of W specimens annealed in Ar and Kr was 100 to 200°C higher than for the specimens annealed in vacuum. (R.V.J.)

**43938** CONTRIBUTION TO THE PROBLEM OF THE INCIPIENT DECOMPOSITION STAGES OF SUPERSATURATED COBALT–TANTALUM AND COBALT–NIOBIUM SOLID SOLUTIONS. **Kokorin, V. V.; Chuistov, K. V. (Inst. of Metal Physics, Academy of Sciences, Ukrainian SSR). Fiz. Metal. Metalloved., 21: 311-14(Feb. 1966). (In Russian).**

Although separation of the excess phase of supersaturated solutions of Ta or Nb in Co upon aging has been studied, no information is available on structural changes occurring during the first stages of the decomposition of the system. This problem was investigated on Co–8 wt % Ta and Co–4 wt % Nb alloys which contain about the limiting amount of additive. After preparation in an arc furnace in purified argon atmosphere, the alloys were hardened and annealed at 1200°C for 10 hours. Structural changes were followed by x-ray diffraction. After quenching in water, the specimens were aged at 500 to 900°C. The course of the decomposition was controlled on the basis of the hardness change. It was found that the excess phase of the Co–Ta alloy precipitates out between 750 and 800°C; that of the Co–Nb alloy between 650° and 750°C; therefore, 750 and 700°C were chosen as the respective incipient decomposition temperatures, heating the specimens to those temperatures in a $10^{-3}$ mm of Hg vacuum. For both alloys laminar regions were observed in the incipient stages of the decomposition; these regions became enriched or depleted in the alloying admixture. These so-called Guinier complexes were found in the planes of the cubic lattice of the initial a solid solution. During the isothermal soaking period, this region became larger, causing a strengthening of the alloy. (TTT)

**43939** MAGNETIC CHARACTERISTICS OF SOME LANTHANIDE NITRIDES. **Schumacher, David P.; Wallace, W. E. (Univ. of Pittsburgh). Contract AT(30-1)-3454. Inorg. Chem., 5: 1563-7(Sept. 1966). (TID-23104).**

Magnetic susceptibilities ($\chi$) of Y, La, Ce, Nd, Sm, Yb, Lu, and their nitrides were determined over a temperature range extending from 2 to 300°K. Y, La, and Lu and their nitrides are Pauli paramagnets. SmN orders antiferromagnetically below 13°K. NdN exhibits ferromagnetic ordering below 35°K. Its magnetic moment in the ferromagnetic state at 2°K is 2.15 $\mu_B$, as contrasted with 3.3 $\mu_B$ for the free $Nd^{3+}$ ion. The reduction is ascribed to crystal field quenching. From the measured moment an over-all splitting of the ground state $Nd^{3+}$ ion multiplet is estimated to be 234°K. The effective moment of Nd in paramagnetic NdN is in good agreement with that expected for the free ion. YbN exhibits Curie–Weiss behavior at >100°K with a moment in fair agreement with that expected for the $Yb^{3+}$ ion. However, the magnitude of $\chi$ for YbN and the low-temperature deviation from Curie–Weiss behavior are not understood. Results for Yb indicate 34% $Yb^{3+}$ and 66% $Yb^{2+}$. The CeN results indicate a mixture of $Ce^{3+}$ and $Ce^{4+}$ with the latter strongly predominating at low temperatures. In accordance with theoretical expectations no magnetic ordering is observed for CeN and YbN at temperatures down to 2°K. (auth)

**43940** INVESTIGATION OF SOME PROPERTIES OF NIOBIUM ALLOYS. **Prokoshkin, D. A.; Vasil'eva, E. V.; Chudarev, L. F. Izv. Vyssh. Ucheb. Zaved., Tsvetn. Metal., No. 3, 118-22(1966). (In Russian).**

Complex alloying of Nb with Mo and Ti at 1000 to 1100°C improved the hardness of the metal while additions of 2% B prevented creep and added strength. Additions of Mo and Ti also improved the heat resistance of the metal. Small amounts of B and Zr additions had no effect on the heat resistance. (R.V.J.)

**43941** CREEP OF POLYCRYSTALLINE THORIUM DIOXIDE. **Poteat, L. E.; Yust, C. S. (Oak Ridge National Lab., Tenn.). J. Amer. Ceram. Soc., 49: 410-14 (Aug. 21, 1966). (ORNL-P-1623).**

The creep rate of polycrystalline $ThO_2$ is reported for 1400 to 1800°C and for 4000, 7500, and 11,000 psi. The microstructure of deformed specimens contained intergranular voids which formed by the apparent growth and coalescence of pores along the grain boundaries. Grain-boundary sliding also occurred during creep. The strain rate-stress relation indicates a viscous type of creep process. A mechanism of creep is proposed which involves a diffusional transport of material and which accounts for the appearance of the intergranular voids. (auth)

**43942** LOW-TEMPERATURE ELASTIC PROPERTIES OF ZrC AND TiC. **Chang, Roger; Graham, L. J. (North American Aviation Science Center, Thousand Oaks, Calif.). J. Appl. Phys., 37: 3778-83(Sept. 1966).**

The elastic constants of zirconium carbide and titanium carbide were determined over the temperature range of 4.2° to 298°K using a pulsed-ultrasonic phase comparison technique, and are compared to previously determined values for uranium carbide. Since these carbides are of the NaCl structure, only three independent constants are required to describe their elastic behavior. Their values at 298°K are

| | $ZrC_{0.94}$ | $TiC_{0.91}$ |
|---|---|---|
| $C_{11}$ | 4.720 ± 0.005 | 5.145 ± 0.005 |
| $C_{12}$ | 0.987 ± 0.005 | 1.060 ± 0.002 |
| $C_{44}$ | 1.593 ± 0.002 | 1.788 ± 0.002 |

are in units of $10^{12}$ dyn/cm$^2$. The differences in the elastic behavior of these group IV, transition metal carbides and the monocarbide of uranium are discussed in reference to their different electronic structure. (auth)

**43943** SLIP AND FRACTURE IN SINGLE CRYSTALS OF THORIA. **Edington, J. W.; Klein, M. J. (Battelle Memorial Inst., Columbus, Ohio). J. Appl. Phys., 37: 3906-8(Sept. 1966).**

Hardness impressions were made on {111} faces of single crystal specimens of thoria in the temperature range room temperature to 900°C. Etch-pit studies of slip lines formed around these impressions are consistent with slip on {100} planes. This slip plane was positively identified by etch-pit studies of adjoining {111} faces of single crystals deformed at 900°C, and also transmission electron microscopy studies of foils cleaved at room temperature. Examination by electron microscope indicated that the Burgers vector of dislocations in thin foils produced by cleavage was ½a[110]. The fracture plane at room temperature and 900°C was identified as {111}. (A.G.W.)

**43944** HIGH TEMPERATURE PVT PROPERTIES OF SODIUM, POTASSIUM, AND CESIUM. **Stone, J. P.; Ewing, C. T.; Spann, J. R.; Steinkuller, E. W.; Williams, D. D.; Miller, R. R. (Naval Research Lab., Washington, D. C.). J. Chem. Eng. Data, 11: 309-14(July 1966).**

Pressure-volume-temperature properties are presented for three alkali metals—Na, K, and Cs. The data for each metal cover an extended temperature range from the normal boiling point to 2550°F. (auth)

**43945** HIGH TEMPERATURE VAPOR PRESSURES OF SODIUM, POTASSIUM, AND CESIUM. **Stone, J. P.; Ewing, C. T.; Spann, J. R.; Steinkuller, E. W.; Williams, D. D.; Miller, R. R. (Naval Research Lab., Washington, D. C.). J. Chem. Eng. Data, 11: 315-20(July 1966).**

Saturation pressures were measured for Na, K, and Cs to temperatures of 2540, 2400, and 2350°F, respectively, using a static method and a refractory metal apparatus with a diaphragm as a null-point detector. Vapor-pressure equations of the Kirchhoff type accurately represent the observed data for extended temperature ranges with standard per cent deviations of ±0.52 for Na, ±0.43 for K, and ±0.53 for Cs. (auth)

**43946** HIGH TEMPERATURE SPECIFIC VOLUMES OF LIQUID SODIUM, POTASSIUM, AND CESIUM. **Stone, J. P.; Ewing, C. T.; Spann, J. R.; Steinkuller, E. W.; Williams, D. D.; Miller, R. R. (Naval Research Lab., Washington, D. C.). J. Chem. Eng. Data, 11: 320-2(July 1966).**

The specific volumes of liquid Na, K, and Cs (at saturation) were measured with pycnometers over the temperature ranges from 1577 to 2491°, 1099 to 2287°, and 1577 to 2304°F, respectively. The results are correlated with those for lower temperatures, and the specific volume of each metal is well defined by a single equation from its melting point to the maximum temperature of the measurements. (auth)

**43947** THERMODYNAMIC PROPERTIES OF URANIUM CARBIDES VIA THE U-C-O SYSTEM. **Leitnaker, James M.; Godfrey, T. Gordon (Oak Ridge National Lab., Tenn.). J. Chem. Eng. Data, 11: 392-4(July 1966). (ORNL-P-1863).**

Equilibrium data of Piazza and Sinnott in the systems $UO_2$-$UC_2$−C−CO and $UO_2$-$UC_2$−UC−CO were recalculated using both second and third law treatments. Internal consistency is excellent for the first system and acceptable for the second. Third law treatments predict the heats of formation, $\Delta H^0_{f298}$, $UC_2$, and UC to be −20.5 and −23.2 kcal per mole, respectively, in excellent agreement with combustion measurements. The "best" value of $\Delta H^0_{f298}$ $UC_2$ is −20.8° 0.7 kcal per mole. (auth)

**43948** STABILITY OF PHASES IN THE CESIUM-GRAPHITE SYSTEM. **Salzano, F. J.; Aronson, S. (Brookhaven National Lab., Upton, N. Y.). Contract AT(30-2)-Gen-16. J. Chem. Phys., 45: 2221-7(Sept. 15, 1966). (BNL-10194).**

The thermodynamic properties of Cs−graphite lamellar compounds prepared from natural graphite flakes were studied at 400° to 800°C. The factors that contribute to the thermodynamic properties of the compounds are discussed. The stability and structure of the stages below $C_{10}Cs$ can be understood on the basis of a semiempirical reaction mechanism in which it is assumed that the Cs is fully ionized. The reaction mechanism considers the following parameters: the energy required to separate the carbon layers upon formation of the compounds; the density of Cs in the filled layers; the electrostatic interactions between Cs-filled layers; and the bonding energy of Cs in the filled layers. Deviations in the heats of formation from those predicted by the model occur in the case of $C_8Cs$ and $C_{10}Cs$. These deviations are attributed to the unique structure of $C_8Cs$ and $C_{10}Cs$ in which each carbon layer is sandwiched between two layers of Cs. (auth)

**43949** DEFORMATION OF ANODIC OXIDE FILMS. **Bubar, S. F.; Vermilyea, D. A. (General Electric Research and Development Center, Schenectady, N. Y.). J. Electrochem. Soc., 113: 892-5(Sept. 1966).**

Films of $Ta_2O_5$ on smooth, pure substrates can be deformed as much as 50% before fracture. On surfaces containing impurity particles the films contain many flaws which nucleate cracks after relatively little deformation. Films of $ZrO_2$ showed some evidence of deformation, but much less than $Ta_2O_5$. Films of $Al_2O_3$ showed no evidence of deformation. (auth)

**43950** OPTICAL PHENOMENON IN $LiNbO_3$ SINGLE CRYSTALS. **Croft, W. J.; Kestigian, M. (Sperry Rand Research Center, Sudbury, Mass.). J. Electrochem. Soc., 113: 960-1(Sept. 1966).**

Examination of large $LiNbO_3$ single crystals shows the presence of oriented intergrowths with high-order interference colors under low magnification in parallel polarized light (crossed nicols). It appears that this phenomenon is caused by stress-induced incipient cleavage development. Another phenomenon observed in the crystals is linear rows of five chips parallel to the growth of the boules. Microscopically, these chips appear curved and probably represent incipient face growth. (J.R.D.)

**43951** PREPARATION AND PROPERTIES OF ULTRAFINE CARBIDES, NITRIDES, AND METALS. **Neuenschwander, E. (Abteilung fuer Seltene Metalle, Basel). J. Less-Common Metals, 11: 365-75(1966). (In German).**

Chlorides of refractory metals were reacted in a jet of hydrogen of a mean temperature of 3000°C with methane to form carbides and with nitrogen to form nitrides. Furthermore, the jet of hydrogen was used to reduce the chlorides to the metals. Ultrafine products with particle sizes in the range 100−1000 Å were obtained. TaC, NbC, TiC, TaN, and W are given as examples and their properties are described. (auth)

**43952** FORMATION OF TUNGSTEN AND ALUMINUM CARBIDES BY EXPLOSIVE SHOCK. Horiguchi, Y. (Inst. of Physical and Chemical Research, Tokyo); Nomura, Y. J. Less-Common Metals, 11: 378-80(1966).

Mixtures of tungsten and aluminum powders respectively with acetylene black were subjected to explosive shock caused by charges of tetryl. The products obtained were powdered and examined by x-ray diffraction. In the case of tungsten, the products were about 98% tungsten carbides, 1.74% free carbon, and a trace of W. The Al reaction produced about 42.5% $Al_4C_3$. (A.G.W.)

**43953** THE EFFECTS OF HIGH PRESSURE ON THE ALPHA ⇌ BETA TRANSFORMATION IN PLUTONIUM. Liptai, R. G.; Friddle, R. J. (Argonne National Lab., Ill.). J. Nucl. Mater., 20: 48-56(July 1966).

The volume change during the $\beta \rightarrow \alpha$ transformation in Pu varies linearly with pressure according to the relation $\Delta V/V = 9.2 - 0.17\ P$, where $\Delta V/V$ is the % change in unit volume and P is the applied pressure. The temperature hysteresis associated with the $\alpha \rightleftharpoons \beta$ transition is shown to be a function of internal transformation stress and applied pressure, decreasing from its maximum of 55°K at atmospheric pressure to 5°K at 25 kbar. The heat of transformation calculated from the Clausius-Clapeyron equation and P−V−T data remains constant to pressures of 60 kbar. (auth)

**43954** CARBON DIFFUSION IN THE CARBIDES OF NIOBIUM. Brizes, Wm. F.; Cadoff, L. H.; Tobin, J. M. (Westinghouse Astronuclear Lab., Pittsburgh). J. Nucl. Mater., 20: 57-67(July 1966).

The reaction between Nb and graphite was investigated at 1700 to 2300°C. Parabolic growth behavior was observed for the $Nb_2C$ and NbC phases. The rate constants for layer growth can be expressed as $K_{Nb_2C} = 0.3 \exp(-80.7\ \text{kcal/mole/RT})\ \text{cm}^2/\text{sec}$ and $K_{NbC} = 17.6 \exp(-96.2\ \text{kcal/mole/RT})\ \text{cm}^2/\text{sec}$. It was demonstrated that Nb-atom diffusion in the carbides is negligible compared with that for C. The C diffusivity in NbC was determined to be $D^{C}_{NbC} = 7.6 \exp(-88.2\ \text{kcal/mole/RT})\ \text{cm}^2/\text{sec}$ assuming that D is independent of concentration. The diffusivity of C in $Nb_2C$ could not be accurately determined due to the lack of reliable high temperature phase equilibria data. Evidence is presented which suggests that the diffusivity in NbC decreases with increasing C composition. (auth)

**43955** ELECTRON MICROSCOPY OF BETA-URANIUM. Coll, J. A. (Comision Nacional de Energia Atomica, Buenos Aires). J. Nucl. Mater., 20: 68-74(July 1966). (In French).

Electron micrographic examination of films of U-1 at. % Cr alloy quenched from the $\beta$ phase has permitted the direct observation of the zonal dislocations proposed by Kronberg to explain (110) [001] slip, and of stacking-faults on the (100) plane which confirm Rodriguez and Coll's model for the (100) [001] slip system. The stacking-faults are compared with those studied by Marcinkowski and Miller in Fe−Cr $\sigma$ phase. These two types are considered to differ since the latter are created from a phase transformation while the former result from crystallographic slip. (auth)

**43956** DETERMINATION OF THE PRINCIPAL THERMAL EXPANSION COEFFICIENTS OF $\alpha$ ZIRCONIUM. Couterne, J. C.; Cizeron, G. (Institut National des Sciences et Techniques Nucleaires, Saclay, France. Ecole des Mines, Paris). J. Nucl. Mater., 20: 75-82(July 1966). (In French).

The true mean thermal expansion coefficients of $\alpha$Zr along the principal crystal axes were determined by dilatometry of a hotdrawn rod, the texture of which had been quantitatively determined. Two sets of samples were prepared in such a way that their long axes were parallel to different, known crystal vectors. Dilatometry of these samples allows the expansion coefficients along these vectors to be determined. Since the textures are quantitatively known, the expansion coefficients along the a and c crystal axes can be then derived. It was found that the expansion coefficient along the a axis diminishes sharply above 400°C, and the ratio c/a rises sharply above this temperature. This may be due to a change in electronic structure. (auth)

**43957** HIGH FREQUENCY FATIGUE LIFE OF SOME MAGNESIUM ALLOYS USED IN FUEL ELEMENT APPLICATIONS. Suhr, R. W. (English Electric Co. Ltd., Whetstone, Eng.). J. Nucl. Mater., 20: 94-103(July 1966).

Resonant transverse vibration fatigue tests of constant strain amplitude carried out on the Mg alloys ZR55, ZR57 (both Mg−Zr), MN70 (Mg−Mn), and AL80 (Magnox) are described in the strain range $4 \times 10^4$ to $3 \times 10^{-3}$ at frequencies of 150 cps, 1000 cps, and 8000 cps at 400°C. A method is also described by which the inelastic component of the strain may be evaluated from measurements of the resonant frequency of the fatigue specimens. These values are used to show that the fatigue life of the alloys can be expressed in the form $\epsilon_p T^m = C$, where $\epsilon_p$ is the inelastic strain range, T the time to failure and m and C are constants independent of frequency. (auth)

**43958** DENSITY CHANGES UPON HEAT-TREATING UNIRRADIATED "PURE" AND "ADJUSTED" URANIUM. Lobb, R. C. (Central Electricity Generating Board, Berkeley, Eng.). J. Nucl. Mater., 20: 104-7(July 1966).

An accurate measuring technique was used to evaluate the density changes on quenching high-purity U and reactor grade U containing 250 ppM Fe and 630 ppM Al. The recovery of the density on subsequent $\alpha$-annealing was followed. It is concluded that the density changes are a consequence of solution and precipitation of $UAl_2$. (auth)

**43959** ELECTRICAL RESISTIVITY STUDY OF RECOVERY PHENOMENA IN COLD-WORKED ZIRCONIUM. Desalvo, A.; Zignani, F. (Univ., Bologna. CNR, Bologna). J. Nucl. Mater., 20: 108-18(July 1966).

The recovery of Zr of two different purities, cold rolled to 80% reduction at room temperature, was followed by means of electric conductivity measurements at −196°C. In 99.5% Zr, recovery proceeds mainly in two stages. The first stage (stage A1) ranging between room temperature and ~315°C, is characterized by an activation energy increasing linearly with recovered extra resistivity between 1.00 and 1.85 ev and obeys logarithmic kinetics. This has been attributed to a small scale dislocation rearrangement. The second stage (stage B1), centered at 475°C, is characterized by an activation energy of 2.30 ± 0.25 ev and corresponds to recrystallization. In 99.95% Zr, stage B1 is lowered to ~325°C and is characterized by an activation energy of 1.70 ± 0.15 ev. On the other hand, the first recovery stage begins only above 100°C and is characterized by a constant activation energy of 1.35 ± 0.05 ev (stage A2). This may be reasonably attributed to point defect annealing, which probably occurs also in 99.5% Zr, but remains unresolved under the continuous background due to dislocation rearrangement. (auth)

**43960** IMPROVED TESTING DEVICE FOR MEASURING TANGENTIAL EXPANDABILITY OF BERYLLIUM TUBE. Mishima, Yoshitsugu (Tokyo Univ.). J. Nucl. Sci. Technol. (Tokyo), 3: 294-7(July 1966).

An improved device was developed for measuring the tangential expandability of cladding tubes, especially in Be, which is important since the difference in thermal expansion coefficient between Be and $UO_2$ will cause stress, and bring about tangential elongation of the cladding at temperatures below 250°C every time the reactor is shutdown. Two new devices were developed, and upon comparison, the better method was found to be that incorporating a cylindrical lead plastically deforming insert of length best suited to the specimen length. This apparatus can produce in the Be cladding a uniaxial tangential tensile stress tending to expand the tube dia reproducing the conditions prevailing in the case of reactor shutdown. Preliminary test results on Al and Magnox tubes, and a first account of the results obtained on Be tube fabricated through various processes are given. (auth)

**43961** HIGH-TEMPERATURE THERMOMECHANICAL TREATMENT OF THE β ALLOY OF THE Ti–Mo–Cr–Fe–Al SYSTEM. Ageev, N. V.; Glazunov, S. G.; Petrova, L. A.; Tarasenko, G. N.; Grankova, L. P.; Shelest, A. E. Metalloved. Term. Obrabotka Metal., No. 5, 12-14(1966).

Forged specimens of complex titanium-base alloy containing 7% Mo, 5.5% Cr, 3% Fe, and 3%Al were subjected to high-temperature thermomechanical treatment (HTMT), rolled at 850, 950, and 1050°C with a 20, 40, and 60% reduction in one pass and 80% in two passes, immediately water quenched, and then aged at 450°C for 15 and 25 hr at 500°C for 5 and 10 hr, or at 525°C for 5 hr. HTMT increased alloy strength without affecting ductility. For example, prior to aging the tensile strength of alloy hot-rolled at 950°C with a reduction of 20, 40, 60, and 80% was 96.5, 105.0, 96.7, and 99.5 kg/mm$^2$, respectively, compared with 77.3 kg/mm$^2$ for alloy quenched from the same temperature without deformation. The corresponding figures for elongation were 16.6, 18.4, 17.7, and 18%, respectively, compared with 16.9%. The increased strength of the alloy after HTMT is explained by strain hardening and fragmentation of the β-alloy grains. Aging produced a further significant increase of strength. The best combination of strength and ductility was obtained after HTMT with 60–80% reduction at 850°C and aging at 500°C for 10 hr or 525°C for 5 hr, after which the alloy had a tensile strength of 164–177 kg/mm$^2$, an elongation of 4.5–9.0%, and a reduction of area of 8–15%. This effect of aging was found to result from the precipitation of the finely dispersed α phase. (ATD)

**43962** NEW TECHNIQUE FOR CHEMICAL-THERMAL TREATMENT OF TRANSITION METALS IN MOLTEN ALUMINUM-BASE ALLOYS. Zemskov, G. V.; Shulenok, P. F. (Odessa Polytechnic Inst.). Metalloved. Term. Obrabotka Metal., No. 5, 52-5(1966). (In Russian).

A hot-dip method for applying aluminum-alloy coatings on transition metals such as Ti, Nb, and Mo was developed. The surface of transition metals should be activated to ensure a satisfactory adhesion of the coating to the base metal. Several methods of activation were tested. The best results were obtained by dipping into a fluoride-base flux and by oxidation in air at elevated temperatures, 400 to 550°C for VT1 Ti, 250 to 350°C for VN1 Nb, and 350 to 450°C for VM1 Mo. The latter method ensures a satisfactory continuity of the coating and a satisfactory adhesion between the coating and the base metal. Complex Al-alloy coatings have a much higher protective ability than pure Al coating. Al coating on VN1 Nb began to peel after 50 hr at 850 to 900°C and Al–Si–Mo alloy coating, after 100 hr at 1000 to 1100°C; Al–Si–Mo–Nb–Cr alloy coating was only slightly damaged after 200 hr at 1250 to 1300°C. Al–Si–Mo–Cr alloy coating protects VM1 Mo at 1500°C for at least 30 hr. The protective ability of these coatings may be utilized also in hot plastic working of refractory metals. (ATD)

**43963** SPRING NIOBIUM-BASE ALLOY WITH STABLE ELASTICITY MODULUS AT HIGH TEMPERATURE. Borisova, A. K.; Belov, B. G. Metalloved. Term. Obrabotka Metal., No. 6, 10-11(1966). (In Russian).

The properties and behavior of niobium-base alloys containing 55% Nb, 39.5% Ti, and 5.5% Al were investigated. Alloys were rolled at 1160–1180°C into sheets 3.5–4 mm thick, annealed at 1000°C, water quenched, and rolled at 300–350°C to a thickness of 0.3–0.1 mm with process annealing at a thickness of 1.0–0.16 mm. Total reductions after process annealing amounted to 35–40%. Rolled specimens were aged (400–800°C for 3 hr) or annealed at 1000°C and aged. Aging sharply increased the hardness and strength of both as-rolled and annealed specimens with the maximum effect produced by aging at 600–650°C. The microstructure of tempered strain-hardened alloys consists of a finely dispersed heterogeneous mixture of solid solution and, apparently, the $(NbTi)_3Al$ compound. The hardness of alloys annealed in vacuum at 1000°C and then tempered in vacuum was found to be 241 HB at room temperature, 197 HB at 500°C, and 179 HB at 600°C. In stress-relaxation tests at 500°C, the initial stress of 43.5 kg/mm$^2$ in as-rolled and aged specimens dropped about 19%. As-rolled alloy had a tensile strength and elongation of 90.5 kg/mm$^2$ and 7%, respectively, and after aging at 725°C, 120 kg/mm$^2$ and 7%. The strength and ductility of as-annealed alloy were 67 kg/mm$^2$ and 25%, respectively, and after aging, 95 kg/mm$^2$ and 3%. The alloy has a modulus elasticity of about 1200 kg/mm$^2$ and the temperature coefficient of elasticity modulus at 20–600°C was found to be 70–80 × $10^{-6}$1C. The alloy is recommended as an age-hardenable, nonmagnetic, corrosion-resistant material with a stable elasticity modulus at high temperature for springs operating at elevated temperatures in aggressive media. (ATD)

**43964** THERMAL EXPANSION OF THE SOLID SOLUTIONS OF REFRACTORY METALS OF THE IV, V, AND VI GROUPS OF THE PERIODIC SYSTEM. Pradantseva, K. S.; Soloveva, N. A. Metalloved. Term. Obrabotka Metal., No. 6, 41-4(1966). (In Russian).

In a search for high-temperature alloys with a low coefficient of linear expansion for vacuum-tight joints with inorganic dielectrics (glass, mica, sapphire), the thermal expansion of the single-phase solid solutions of the binary alloys of the Mo–Cr, Mo–Nb, Mo–Ta, Mo–V, Cr–V, Nb–V, Zr–Ti, and Zr–Hf systems was investigated at temperatures up to 800 to 900°C. Except for 98.19%-pure V, the metals used in alloys had a purity of 99.9% or higher. The majority of the alloys and their components (pure refractory metals) were melted in a nonconsumable electrode arc furnace in an argon atmosphere at a pressure of 160–200 mm Hg; Cr–V alloys were melted in a h-f induction furnace, and Zr–Ti alloys were prepared by the powder metallurgy method. The alloys were homogenized at 1000–1800°C. The coefficient of linear expansion of all the alloys tested changed almost linearly with the alloy composition. On the basis of the experimental data, several refractory nonmagnetic alloys with predetermined low coefficients of linear expansion and other properties were selected. New Zr-base precision alloys were developed, which have good ductility and can be rolled into strip or foil and drawn into wires of various cross sections. These alloys can be used for making vacuum-tight joints with certain inorganic dielectrics. (ATD)

**43965** EFFECT OF STRESS ON STRAIN AGEING. Almond, E. A.; Hull, D. (Univ. of Liverpool). Phil. Mag. (8), 14: 515-29(Sept. 1966).

The effect of applying a tensile stress during the strain aging of Fe, Nb and Ta has been studied. The upper yield stress, the lower yield stress and the yield point elongation are all increased when tensile specimens are aged under stress but the flow stress and damping capacity are unaffected. Tensile test results, damping measurements and electron microscope observations all indicate that the process responsible for the strengthening effect is one involving dislocation rearrangement rather than a stress-enhanced diffusion mechanism. (auth)

**43966** DIRECT OBSERVATION OF ETCH PITS AT DISLOCATIONS IN MOLYBDENUM. Prekel, H. L.; Lawley, A. (Franklin Inst., Philadelphia). Phil. Mag. (8), 14: 545-61(Sept. 1966).

The correlation between etch-pits and dislocations in Mo has been examined by optical microscopy and replication techniques on bulk single crystals, and transmission electron microscopy of etched thin foils. Dilute Murakami chemical etch gives a one-to-one correspondence between etch-pits and dislocations on {421} planes; however, for other orientations and/or solutions, the one-to-one correspondence no longer exists. Detailed examination of the {421} plane shows that: (a) dislocation decoration by impurities is not required for etch-pitting; (b) annealing of as-grown crystals in hydrogen at ~1900°C reduces the dislocation density from ~6 × $10^7$ cm$^{-2}$ to ~$10^6$ cm$^{-2}$, with an accompanying rearrangement of dislocations into sub-grain boundaries; (c) standard strength Murakami etch produces etch-pits at dislocations and at other sites in the matrix; (d) the shape and orientation of the etch-pits is independent of the Burgers vector or angle of inclination of the dislocation to the free crystal surface.

The etching behavior is considered in the light of proposed mechanisms and an attempt is made to explain the discrepancies observed. (auth)

**43967** ON THE PRASEODYMIUM–OXYGEN SYSTEM. Hyde, B. G.; Bevan, D. J. M.; Eyring, L. (Arizona State Univ., Tempe). Phil. Trans. Roy. Soc. London, Ser. A, 259: 583-614(May 19, 1966). (COO–1109-20).

An isobaric survey of the system $PrO_2$ + oxygen was made at $O_2$ pressures between 0 and 1 atm and in the temperature range from 200 to 1150°C. The derived isobaric sections enable a three-dimensional phase diagram (pressure, temperature, and composition) to be constructed with considerable certainty and detail for the composition range $PrO_{1.65}$ to $PrO_{1.84}$. Reasonable extensions covering the complete range between the sesquioxide and dioxide are proposed, and a projection of the diagram on to the temperature-composition plane is presented. At lower temperatures several discrete, ordered phases of narrow homogeneity range exist. These constitute an homologous series $Pr_nO_{2n-2}$, with $n = 4, 7, 9, 10, 11, 12, \infty$. At higher temperatures two wide-range solid solutions were obtained: σ, a body-centered cubic phase of composition ca. $PrO_{1.80}$ to $PrO_{1.70}$ and α, a face-centered cubic phase of composition ca. $PrO_{1.72}$ to $PrO_2$. The fields of solubility of the various phases are defined and the ambient conditions at many variant axes are enumerated. Miscibility gaps with upper consulate points are exceptional; order-disorder peritectoid transformations are common. Hysteresis in phase transformations is confirmed, and the results further demonstrate evidence of metastable states in phase reactions involving an increase in structural order. The appearance of these pseudo-phases and the nature of the nonstoichiometry is explained in terms of plausible model invoking microdomain texture in defect solids. (auth)

**43968** KINETICS OF COMPLEX DEFECT ANNEALING IN SILICON. Fang, P. H. (Goddard Space Flight Center, Greenbelt, Md.). Phys. Lett., 23: 7-10(Oct. 3, 1966).

The dependence of the residual unannealed defect on the defect concentration is shown to provide a stringent test for annealing models, from which the presently existing annealing models are shown to disagree even qualitatively with the experimental results. (auth)

**43969** PROSPECTS OF RAISING THE HIGH-TEMPERATURE STRENGTH OF MATERIALS ON THE BASIS OF REFRACTORY METALS. Larikov, L. N.; Zasimchuk, E. E. Porosh. Met., Akad. Nauk Ukr. SSR, No. 8, 38-42 (Aug. 1966). (In Russian).

The principles of the effective alloying of refractory metals, based on the softening mechanism, are discussed. As rhenium in recrystallization is greatly softened, the high-temperature strength can be increased by alloying, based on the same principles used in developing alloys on aluminum, cobalt, and nickel bases. Other refractory metals (tungsten, molybdenum, niobium) are softened to a greater extent or completely before recrystallization because of polygonization processes; therefore the high-temperature strength can be increased in these refractory metals and in their alloys because of the deceleration of polygonization processes. The mechanisms of influence of admixtures on the polygonization rate are discussed. (auth)

**43970** EFFECT OF VANADIUM AND MOLYBDENUM ON THE PROPERTIES AND PHASE CONVERSIONS OF THE METALLIDE $TiCr_2$. Samsonova, N. N.; Budberg, P. B. Porosh. Met., Akad. Nauk Ukr. SSR, No. 8, 49-54 (Aug. 1966). (In Russian).

The effects of vanadium and molybdenum on the properties and phase conversions of the metallide $TiCr_2$ were investigated. The temperatures of peritectoid reactions occurring in the $TiCr_2$–V and $TiCr_2$–Mo alloy sections of the ternary systems Ti–V–Cr and Ti–Cr–Mo were determined. (auth)

**43971** TERNARY CHEMICAL COMPOUNDS IN THE Ni–Ti–Nb SYSTEM. Pryakhina, L. I.; Myasnikova, K. P.; Burnashova, V. V.; Cherkashin, E. E.; Markiv, V. Ya. Porosh. Met., Akad. Nauk Ukr. SSR, No. 8, 61-9(Aug. 1966). (In Russian).

Four ternary chemical compounds in the system Ni–Ti–Nb in the compositions 80Ni–5Ti–15Nb, 75Ni–5Nb–20Ti, 75Ni–13Nb–12Ti, and 56Ni–29Ti–15Nb were discovered for the first time by the methods of roentgenostructural analysis. Isothermal phase equilibria at temperatures of 1000 and 900°C are plotted. (auth)

**43972** INTERMETALLIC COMPOUNDS OF RARE-EARTH METALS WITH ALUMINIUM AND SOME OF THEIR PROPERTIES. Podergin, V. A. Porosh. Met., Akad. Nauk Ukr. SSR, No. 8, 76-85(Aug. 1966). (In Russian).

The data in the literature on the systems of rare-earth metals with Al are generalized, taking into account new results obtained on using rare-earth elements of high purity. The intermetallic compounds are systematized. A summary table is given of the crystallographic and some physical and chemical properties of all known intermetallic compounds. (auth)

**43973** PHASE COMPOSITION AND SOME PROPERTIES OF ALLOYS OF THE MOLYBDENUM–NICKEL–BORON SYSTEM. Kolomytsev, P. T.; Moskaleva, N. V. Porosh. Met., Akad. Nauk Ukr. SSR, No. 8, 86-92(Aug. 1966). (In Russian).

Isothermal sections of the state diagram of Mo–Ni–B at 1200, 1000, and 800° are plotted. The ternary boride phase $Mo_2NiB_2$ is investigated. Some physical chemical, and mechanical properties of alloys and phases formed in the system were determined; the heat-resistance of some alloys at 1000°C was also studied. The most heat-resisting alloys were those with a structure of α-Mo solid solution, reinforced by the $Mo_2B$ phase. (auth)

**43974** GRAIN BOUNDARY AND LATTICE DIFFUSION OF SILVER IN ZIRCONIUM USING TRACER TECHNIQUE. Naik, M. C.; Agarwala, R. P. (Atomic Energy Establishment, Trombay, India). pp 282-90 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Experiments were performed dealing with grain boundary and lattice diffusion of $^{110}Ag$ in high-purity polycrystalline Zr. Lattice diffusion was calculated by residual activity from 0.656-Mev γ radiations and is presented in tabular form. Activation energy for the diffusion of $^{110}Ag$ in β-zirconium was nearly double the value in α-zirconium; this higher value was attributed to an increase in the binding forces of β-zirconium–silver solid solutions. It was concluded that diffusion in Zr does not take place through vacancy mechanisms only. (P.C.S.)

**43975** PECULIARITIES OF THE ATOMIC STRUCTURE OF A Ta–Nb SOLID SOLUTION. Umanskii, Ya. S.; Fadeeva, V. I. (Moscow Steel and Alloy Inst.). Soviet Phys.-Cryst. (Engl. Transl.), 11: 193-5(Sept.-Oct. 1966).

Translated from Kristallografiya, 11: 196-9(Mar.-Apr. 1966).

The equimolar Ta–Nb solid solution was investigated by analyzing diffuse x-ray scattering. The short-range order coefficients $\alpha_i$ were calculated and the atomic-density distribution function was plotted. (auth)

**43976** THERMAL CONDUCTIVITY AND DEGREE OF BLACKNESS OF NIOBIUM AT TEMPERATURES ABOVE 1000 C. Voskresenskii, V. Yu.; Peletskii, V. E.; Timrot, D. L. Teplofiz. Vysok. Temp., 4: 46-9(1966). (In Russian).

An experimental study of the temperature dependence of the thermal conductivity coefficient and integral degree of blackness of Nb was carried out. The specimens were first fired for 4 hr at 2000–2200K. The temperatures were measured in the 1400–2500K range with an OMP-043M optical pyrometer. The data obtained are extensively compared with those of other authors. The discrepancies found show the need for further studies of the thermal conductivity of niobium and its alloys. (M.O.W.)

**43977** THERMAL PROPERTIES OF MOLYBDENUM AT ELEVATED TEMPERATURES. Pigal'skaya, L. A.; Yurchak, R. P.; Makarenko, I. N.; Filippov, L. P. (Moscow State Univ.). Teplofiz. Vysok. Temp., 4: 144-7 (1966). (In Russian).

Molybdenum thermal conductivity at 1000 and 2000°K was studied using a high-frequency induction furnace. Two specimens: one 10 mm in diameter and 70 mm long contained 99.9% Mo with traces of Ni, Si, Mg, and Ca oxides and the other 15 mm in diameter containing 0.28% Ti and 0.18% Zr were measured by alternating heating the side of the cylindrical specimen. The curves of temperature dependence of the specimen electric conductivity are analyzed and compared to published data. (R.V.J.)

**43978** EQUILIBRIUM RELATIONSHIPS IN THE SYSTEM $CuO–Cu_2O–ZrO_2$. Gadalla, A. M. M.; White, J. (Univ. of Sheffield, Eng.). Trans. Brit. Ceram. Soc., 65: 383-90(July 1966).

Phase-equilibrium relationships in the system $CuO-Cu_2O-ZrO_2$ were investigated as a function of temperature and $O_2$ pressure (0.21 to 1.0 atm) using a thermobalance. From the observed relationships, isobaric phase diagrams were constructed and phase boundaries were established in the part of the liquidus surface accessible at these pressures. Contrary to the findings of earlier workers, no indication was obtained of the formation of any compounds between CuO and $ZrO_2$ and a simple ternary eutectic was found to occur at 1067°C and 0.49 atm $O_2$ pressure. (auth)

**43979** A NOTE ON THE TEMPERING BEHAVIOR OF A Ti-9 wt % Ta ALLOY QUENCHED FROM $\beta$ REGION. Yamane, Toshimi; Ueda, Jitsuhiko (Hitachi Shipbuilding and Engineering Co. Ltd., Osaka). Trans. Jap. Inst. Metals, 7: 95-8(Apr. 1966).

Changes in dislocation arrangement and twin faults formation by quenching and tempering of a Ti–9% Ta alloy were investigated by means of internal friction measurements and transmission electron microscopy. It was found that typical needle-like martensite structures were produced by quenching from the $\beta$ region, and by transmission electron microscopy a number of dislocations and $(10\bar{1}1)$ transformation twin were observed. It is suggested from the internal friction measurements that the annihilation of dislocations and twin faults occur during tempering at 300 to 400°C. (auth)

**43980** THE SYSTEM $U–UMn_2–UAl_2–UFe_2$. Petzow, Guenter; Sampaio, A. Oliveira. Z. Metallk., 57: 625-32 (Aug. 1966). (In German).

The quaternary system $U-Mn_2-UAl_2-UFe_2$ was established by thermal, chemical, metallographical, dilatometric and x-ray examinations. The system is represented by poly- and isothermal diagrams. Within the entire system four nonvariant five phase equilibria exist at 760, 715, 660, and 590°C; their extension was located by vertical and lateral projections. The two equilibria mentioned first are transition equilibria of the first kind involving the melt. The other two are solid state eutectoid reactions characterized by the decomposition of the $\gamma$-, resp., $\beta$-solid solution. U-rich alloys corresponding to the composition of the quaternary $\beta$-solid solution show after adequate heat treatment, finely dispersed precipitations of intermetallic phase in the $\alpha$-U matrix. Based on this fact, alloys within this concentration range can be expected to exibit a good resistance to swelling during irradiation similar to adjusted U. (auth)

**43981** $^{133}$Xe DIFFUSION IN UN SINGLE CRYSTALS. Oi, Noboru (Tokyo Shibaura Electric Co., Ltd., Kawasaki, Japan). Z. Naturforsch., 21a: 863-4(June 1966).

Investigation of $^{133}$Xe release from UN single crystals at 1300 to 2400°C in He atmospheres is described. The crystals were prepared by arc-melting U in 280-psi $N_2$. The release was found to be linear with $t^{1/2}$ to about 70 min. (J.R.D.)

**43982** INTERACTION BETWEEN ELECTROMAGNETIC, PLASMA, AND SPIN WAVES IN ANTIFERROMAGNETIC SEMICONDUCTORS AND METALS. Bar'yakhtar, V. G.; Rudashevskii, E. G.; Savchenko, M. A.; Stepanov, K. N. (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksp. Teor. Fiz., 51: 250-7(July 1966). (In Russian).

Coupled electromagnetic, plasma, and spin waves in antiferromagnetic semiconductors and metals are investigated. Since, in contrast to ferromagnetics, there is not one but two spin waves in antiferromagnetics, the spin and electromagnetic (plasma) wave interaction pattern in antiferromagnetics turns out to be more complex than in ferromagnetics. However, in antiferromagnetics the magnetic susceptibility is proportional to a small parameter $\chi_0$ ($\chi_0$ is the static susceptibility) and the spin and electromagnetic oscillation coupling in antiferromagnetics is therefore weak. In the region in which the frequencies of the noninteracting spin and electromagnetic (plasma) branches intersect, the frequency corrections due to wave coupling is of the order of $\sqrt{\chi_0}$ and far away from the intersection region they are of the order of $\chi_0$.

**43983** STUDIES OF U AND U–Zr ALLOYS INCLUDING BEHAVIOR WITH TEMPERATURE CHANGES AND FORMATION OF STRUCTURES. Quaeck, J. Freiberg, Ger., Bergakademie, 1965. 324p. $2.00 Gmelin, AED-Diss. 65-358.

Thesis.

Behavior of U and U–Zr alloys in various temperature ranges is studied. The superior size stability of alloys is explained by a distributed second phase. (130 references) (auth)

**43984** TEKHNOLOGIYA PROIZVODSTVA NIOBIYA I EGO SPLAVOV. (Production Technology of Niobium and Niobium Alloys). Mal'tsev, M. V.; Baikov, A. I.; Solov'ev, V. Ya. Moscow, Izdatel'stvo Metallurgiya, 1966. 292p.

Physico-chemical and mechanical properties of Nb and Nb-alloys are investigated. Metallurgy, powder technology, fabrication technology, and industrial applications of Nb and its alloys are discussed. 280 references are included. (R.V.J.)

## Radiation Effects

### See *also* CHEMISTRY — Radiation Chemistry

*Refer also to abstracts 43810, 44991, 44997, 44998, 45017, 45018, 45022, 45030–45032, 45034, 45037–45040, and 45097.*

**43985** (AAEC-TM-318) ANALYTICAL DESCRIPTION OF GROWTH OF BERYLLIUM OXIDE DURING NEUTRON IRRADIATION. Pryor, A. W.; Hickman, B. S. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr. 1966. 10p. Dep. mn.

An analytical model is developed which describes the available data on the lattice and macroscopic growth of BeO under neutron irradiation. The model is used for interpolation and extrapolation of existing data. The model has a large number of adjustable parameters and it is emphasized that it does not necessarily bear any direct relation to the actual defect structure. (auth)

**43986** (AD-637937) ELECTRON-SPIN-RESONANCE IN FAST-NEUTRON-IRRADIATED PHOSPHORUS-DOPED SILICON. King, C. A. Jr.; Temperley, A. A. (Army Nuclear Defense Lab., Edgewood Arsenal, Md.). Aug. 1966. 25p. (NDL-TM-32). CFSTI $1.00 cy, $0.50 mn.

Damage produced in P-doped Si by fast-neutron irradiation is being investigated. Electron-spin-resonance techniques are used to obtain information which should aid in an understanding of the nature of the lattice defects produced. Preliminary observations concerning the experimental problems involved and the techniques appropriate to their solution are presented. A discussion of the background pertinent to such an investigation is also included. (auth)

**43987** (BNL-10569) BRIEF SURVEY OF RADIATION EFFECTS APPLICABLE TO GEOLOGY PROBLEMS.

Levy, Paul W. (Brookhaven National Lab., Upton, N. Y.). [1965]. Contract AT(30-2)-Gen-16. 23p. (CONF-660919–3). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Conference on Applications of Thermoluminescence to Geological Problems, Spoleto, Italy.

Radiation damage to solids is reviewed with emphasis on the concepts that are applicable to geological problems. The difference between ionization and atom displacement processes is stressed. Topics included are: creation of defects by the different nuclear radiations, intrinsic defects, trapping and recombination centers, thermal untrapping and retrapping, and some qualitative aspects of the growth of radiation induced centers. (auth)

**43988** (BNWL–269, pp 2.1-11) IRRADIATION BEHAVIOR OF CERAMIC FUELS. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

Research progress is reported on irradiation performance of UN-20 wt % PUN, irradiation of ceramic Pu fuels, fission product diffusion in UO$_2$-2 wt % PuO$_2$ pellets, and defective fuel rod performance. (J.R.D.)

**43989** (BNWL–269, pp 3.1-30) PRTR FUEL ELEMENT PERFORMANCE AND FABRICATION. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

Development of a method for high-integrity seals on gas capsules used in irradiation environments is reported. Investigations are described on internal gas pressure measurement in PRTR fuel elements, high power density fuel element irradiations in PRTR, molten-core fuel capsules, PRTR failed fuel elements, and thermal cycling of defective cladding. Fabrication of PRTR-HPD fuels and quality control of PRTR fuels are discussed along with modification of research facilities. (J.R.D.)

**43990** (BNWL-SA–782) DEFECT STRUCTURES IN NEUTRON IRRADIATED NICKEL. Mastel, B.; Brimhall, J. L. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). July 11, 1966. Contract AT(45-1)-1830. 7p. (CONF-660806–1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Electron Microscope Society of America, 24th Annual Meeting, San Francisco, Calif.

Results of neutron irradiation of Ni foils at 40°C are discussed. Results indicate that both vacancy and interstitial defect clusters are produced under these conditions. The displacement spike mechanism is offered to explain the short-range mobility and subsequent clustering of vacancies. Annealing causes breakup of the vacancy clusters into free vacancies which annihilate interstitial clusters and cause other vacancy loops to grow. (J.R.D.)

**43991** (EGG–1183-2096) RADIATION INDUCED ELECTRICAL PHENOMENA IN ORGANIC DIELECTRICS. Technical Note No. S-336-R. Smith, W. A. Jr. (Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). June 1966. Contract AT(29-1)-1183. 56p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

The general aspects of radiation effects in solid and liquid polymers are reviewed, and an attempt is made to identify the major electrical effects induced in a polymeric-type organic insulator used in a device for measuring flux in a high-intensity gamma field. Primary and secondary energy-transfer processes are characterized, and measurements of various material properties before, during, and after irradiation are described and interpreted with respect to radioinduced conductivity. Specific recommendations are made in several areas directly related to the problems of calculating sensitivities of gamma detectors and understanding their electric behavior. (auth)

**43992** (EURAEC–1667) STUDY OF THE RELEASE OF FISSION GASES FROM UO$_2$ SAMPLES IRRADIATED WITH DIFFERENT DOSES. Quarterly Progress Report No. 2, January–March 1966. Baffigo, V.; Gerevini, T. (comps.) (Societa Ricerche Impianti Nucleari, Saluggia (Italy). Centro Ricerche Nucleari). Contract 043-65 TEEI. 14p. (EUR-2859; M/418). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Work Performed under United States–Euratom Joint Research and Development Program.

Modification and maintenance work was continued on the fission gas apparatus set up in the hot cell for handling highly irradiated specimens. The operation of the apparatus for the measurement of fission gases released from small samples has been delayed because of diffusion furnace rig leaks. An experiment on an M.M.N. UO$_2$ specimen (fraction 0.3 – 0.5 mm) was completed. Evaluation of the results is being performed. Eighteen samples are being irradiated at a neutron flux of approximately $5 \times 10^{13}$ n/cm$^2$-sec. (auth)

**43993** (EURAEC–1691) A NEW DETERMINATION OF THE EMBRITTLEMENT IN STEEL USING SMALL SPECIMENS ($\approx$0.2 cc) IN PARTICULAR WITH RESPECT TO IRRADIATION. Progress Report No. M-66-596-50005, April 1, 1966 – June 30, 1966. van Elst, H. C. (Nederlandse Organistaie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague. Metaalinstituut). July 11, 1966. Contract 060-64-11-TEEN. 41p. (EUR-2878). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Work Performed under United States– Euratom Joint Research and Development Program.

The embrittlement of (4 pressure vessel) steels by neutron radiation doses at 80°C was measured using the stress wave attenuation test; earlier results were corroborated. The store facilities for the irradiated specimens had to be extended for newly arrived specimens which received the (highest) dose of ca. $4 \times 10^{20}$ n/cm$^2$ at 80°C. The dynamic stress-strain diagrams at performance of the stress wave attenuation test for some specimens at high and low temperatures were deduced from the recorded oscillograms. Besides the anticipated influence of temperature and irradiation, a delayed deformation was suggested, i.e., an increase of deformation with decrease of stress. (auth)

**43994** (FZK–290) MEASURED EFFECTS OF THE VARIOUS COMBINATIONS OF NUCLEAR RADIATION, VACUUM, AND CRYOTEMPERATURES ON ENGINEERING MATERIALS. Biennial Report, May 1, 1964–May 1, 1966. Kerlin, E. E.; Smith, E. T. (General Dynamics/Fort Worth, Tex.). July 1, 1966. Contract NAS8-2450. 516p.

Tests were performed to evaluate nonmetallic spacecraft materials under various environmental combinations of low temperature, vacuum, and radiation. The materials tested were 8 adhesives, 7 structural laminates, 5 seals, 2 sealants, 19 electrical insulations and dielectrics, 4 thermal insulations, and 12 lubricants. The properties measured were mechanical, lubricative, thermal, and electric properties. The radiation source was the Ground Test Reactor. Details of equipment and tests are included along with the data. (D.L.C.)

**43995** (JAERI–4037) SWELLING OF METALLIC URANIUM. Nagasaki, Rukichi; Kawasaki, Satoru (Japan Atomic Energy Research Inst., Tokyo). Apr. 1966. 14p. (In Japanese). Dep. mn.

The swelling of U metal is caused mainly by coalescence of fission gas bubbles, and sometimes by crack formation. When the gas bubble is small, the pressure of the bubble depends on the surface tension of the matrix. Swelling can be suppressed by dispersing bubbles formed to prevent coalescence. One proposed mechanism of bubble growth is that bubbles migrate by surface diffusion of the matrix atoms and coalesce with one another, and the other that inert gas atoms in small bubbles dissolve into the matrix and precipitate out in larger bubbles. It appears that at high temperatures near the melting point, these two mechanisms are both operative, and at temperatures below this only the former operates. The largest contribution to the swelling of U is the migration of grain boundaries. Various experiments which are involved in the swelling other than by irradiation of U, and the conditions for crack formation in irradiated U metals are also discussed. (auth)

**43996** (LA-DC–7772) AN IRRADIATION CAPSULE FOR MOLTEN Pu ALLOYS. Peterson, P. J. (Los

Alamos Scientific Lab., Univ. of California, N. Mex.). [nd]. Contract W-7405-eng-48. 10p. (CONF-660511-10). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Symposium on Capsule Irradiation Experiments, Pleasanton, Calif.

Design of a static capsule for use in studying fission product distribution between molten Pu fuel and Na in reactor-type environments is described. The Pu fuel alloy is contained in a sealed Ta pin. Results of testing the design are discussed. (J.R.D.)

**43997** (NRL-Memo-1663) IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. Quarterly Progress Report, August 1–October 31, 1965. Steele, L. E.; Serpan, C. Z. Jr.; Hawthorne, J. R. (Naval Research Lab., Washington, D. C.). Nov. 15, 1965. Contract AT(49-7)-2435. 28p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The following are reported: (1) status of reactor radiation damage surveillance programs in several power reactors, (2) the effect of neutron spectra on properties of steels exposed in light water, heavy water, and graphite-moderated reactors, (3) the alleviation of neutron embrittlement of A350-LF1 steel by thermal annealing treatment, and (4) through-thickness Charpy V-notch ductility characteristics of a 4-in. A302-B plate. (D.L.C.)

**43998** (ORNL-3993) POSSIBILITY OF IRRADIATION DAMAGE AFFECTING THE RATE-CONTROLLING MECHANISM FOR SLIP IN BODY-CENTERED CUBIC METALS AND SOLID SOLUTIONS. Arsenault, R. J. (Oak Ridge National Lab., Tenn.). Aug. 1966. Contract W-7405-eng-26. 12p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Most of the experimental data obtained from irradiated body-centered-cubic metals indicate that the rate-controlling mechanism is not changed by the irradiation damage. If these results are considered in terms of previous experimental results from unirradiated body-centered-cubic metals and the theory of thermally activated deformation, the reason for the absence of a change can be explained. However, if the Peierls' stress of a body-centered-cubic metal were reduced, as by alloy addition, then the probability of the irradiation damage affecting the rate-controlling mechanism would increase. (auth)

**43999** (ORNL-TM-1544) SOLUTIONS TO THE PROBLEMS OF HIGH-TEMPERATURE IRRADIATION EMBRITTLEMENT. Martin, W. R.; Weir, J. R. (Oak Ridge National Lab., Tenn.). June 1966. Contract W-7405-eng-26. 29p. (CONF-660627-1). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From American Society for Testing and Materials, 69th Annual Meeting, Atlantic City.

The effect of irradiation on the high-temperature mechanical properties of structural materials is described using type 304 stainless steel as an example. The general effect is one in which the grain-boundary fracture process, but not the deformation process, is affected. The data suggest the primary cause to be He generated from (n,α) reactions. Several metallurgical techniques for improving the ductilities of irradiated alloys are suggested and experimental data on type 304 stainless steel are given for which the degree of improvement is demonstrated. (auth)

**44000** (ORNL-TM-1574) ADDENDUM: INFLUENCE OF CROSS-SECTIONAL SHAPE ON IRRADIATION-INDUCED STRESSES IN GRAPHITE COLUMNS. Witt, F. J.; Greenstreet, B. L. (Oak Ridge National Lab., Tenn.). Aug. 1966. Contract W-7405-eng-26. 18p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A supplement is presented for an earlier paper published in Nuclear Science and Engineering entitled "Influence of Cross-Sectional Shape on Irradiation-Induced Stresses in Graphite Columns." In particular the results from the study of noncircular geometrical shapes are discussed with reference to the complete stress plots for the various configurations. These plots were not presented in full in the original paper. (auth)

**44001** EFFECT OF INTERSTITIAL IMPURITIES ON RADIATION HARDENING AND EMBRITTLEMENT IN IRON. McRickard, S. B.; Chow, J. G. Y. (Brookhaven National Lab., Upton, N. Y.). Acta Met., 14: 1195-1200 (Oct. 1966). (BNL-9718).

A transition to brittle behavior at low temperatures produced in Ferrovac Fe when tensile tested at low temperatures after a fast neutron exposure of 2 × $10^{18}$ nvt at approximately 340°K was not observed after an identical exposure at 203°K. Irradiation at 523°K above an apparent threshold exposure of approximately 1–2 × $10^{18}$ nvt and post-irradiation annealing at 523°K and above also prevent the occurrence of brittle behavior in Fe. The 203 and 523°K irradiation temperatures also reduced the amount of radiation hardening produced by this exposure level although iron irradiated at 340°K required post-irradiation annealing temperatures of 573–623°K to reduce this effect. These data indicate that point defects or simple combinations of them with carbon are responsible for the hardening effects in irradiated Fe, but that a complex carbon-vacancy defect produces embrittlement. (auth)

**44002** EFFECT OF ALPHA BOMBARDMENT ON THE DIFFUSION OF LEAD IN SILVER. Heitkamp, D.; Biermann, W.; Lundy, T. S. (Oak Ridge National Lab., Tenn.). Acta Met., 14: 1201-12(Oct. 1966). (ORNL-P-1162).

The theory of radiation-enhanced diffusion was extended to include the effect of annihilation of point defects (vacancies and interstitials) at a free surface. Predictions are then made for the magnitude of the effect of alpha bombardment on self-diffusion in silver. Experimental values for $^{212}$Pb diffusion in Ag, obtained by the alpha-recoil method of Hevesy and Seith, were compared with the theoretical predictions. (auth)

**44003** DEFORMATION STRUCTURE OF NEUTRON-IRRADIATED COPPER–ALUMINUM ALLOY. Brimhall, J. L.; Mastel, B. (Battelle-Northwest, Richland, Wash.). Appl. Phys. Lett., 9: 127-8(Aug. 1, 1966).

Foils of Cu–8% Al alloy and 99.99% pure Cu were irradiated in a He-filled capsule in a Hanford reactor at 40°C and deformed by pulling in an Instron tensile machine to a maximum strain of 5%. Observations by transmission electron microscopy showed that, in the irradiated Cu, moving dislocations swept up the loops and clusters and produced defect-free channels. At no level of neutron exposure was any interaction of dislocations with clusters detected in the irradiated and deformed Cu–Al alloy. (A.G.W.)

**44004** RESISTIVITY OF THIN SILVER LAYERS DURING HEAVY-ION IRRADIATION. Teodosic, Vlada (Univ. of Aarhus, Denmark). Appl. Phys. Lett., 9: 209-12(Sept. 1, 1966).

Silver layers from 150 to 400 Å thick were bombarded with Ag ions in the energy range 20 to 500 kev. Resistivity was determined as a function of dose, thickness, and ion energy. For all thicknesses and all ion energies, a common type of dependence was found. At the beginning of irradiation, the resistivity decreased, reached a minimum, and then increased. The relative decrease of resistivity was larger for smaller thicknesses; for thicknesses larger than 500 Å it was difficult to recognize any decrease. Possible explanations for the results are considered briefly. (A.G.W.)

**44005** INFLUENCE OF NEUTRON RADIATION ON SOME PROPERTIES OF REFRACTORY CONCRETES. Dubrovskii, V. B.; Ibragimov, Sh. Sh.; Ladygin, A. Ya.; Pergamenshchik, B. K. At. Energ. (USSR), 21: 108-12 (Aug. 1966). (In Russian).

The effects of reactor neutron irradiation (at 2 to 2.4 × $10^{21}$ neutron/cm$^2$ and 550°C) on the properties of Cr concretes with portland cement or liquid glass were studied. It is shown that the concretes retain their strength and elastic properties. Their thermal conductivity and expansion coefficient vary very slightly. It was concluded that the concretes studied are suitable for reactor biological shielding. (R.V.J.)

**44006** RADIATION DAMAGE IN STEEL WITH MEDIUM AND HIGH CARBON CONTENT. Veljkovic, Slobodanka R.; Scepanovic, Aleksa; Stefanovic, Vladeta. Bull. Boris Kidric Inst. Nucl. Sci., 17: 77-88(Apr. 1966).

The radiation damage in Fe and some steels with a medium or high C content was studied. The fast neutron integral flux was $2.5 \times 10^{19}$ n/cm$^2$, and the temperature of the irradiation site was 70 ± 5°C. The damage was measured by changes of the electrical resistivity of samples. The results indicate that a C content in the concentration range 0.01 to 0.93% C had no great effect on the increase of resistivity caused by the irradiation, however, there were variations with structure. Samples annealed at 630°C before irradiation showed the biggest increase of resistivity after the irradiation. (auth)

**44007** NOTES ON THE TWO-PHASE MODEL FOR RADIATION-INDUCED DIMENSIONAL CHANGES IN GRAPHITE. Morgan, W. C. (Battelle-Northwest, Richland, Wash.). Contract AT(45-1)-1830. Carbon, 4: 215-22(July 1966). (BNWL-SA-420).

The historical development and modifications to the single-phase model of the graphite structure, used to interpret and predict behavior during neutron irradiation, are outlined. In the single-phase model all parts of the artificial graphite aggregate are assumed to behave as if they were part of a graphite crystal lattice. It is shown that changes occurring in the non-graphitic carbon phase, relief of internal stresses inducing during cool-down from graphitization temperature, and changes in the crack structure of the graphite aggregate must also be considered in interpretation of dimensional changes produced during high-temperature irradiations. (auth)

**44008** ELECTRON SPIN RESONANCE IN NEUTRON-IRRADIATED AND IN DOPED POLYCRYSTALLINE GRAPHITE. PART II. Mrozowski, S. (State Univ. of New York, Buffalo). Carbon, 4: 227-42(July 1966).

In continuation of the study of influence of neutron irradiation and of doping on the electron spin resonance in incompletely graphitized P33 carbon black (HTT 2600°C), variable amounts of B were introduced by heating grains of solid P33 mixed with $H_3BO_3$ powder to a temperature 1600°-1800°C. With increasing B content the ESR line shifts gradually from the undoped position $g_p$ towards the free electron value $g_f$, the temperature dependence of the g-value reversing its direction at about $g = g_f + 0.7\ (g_p - g_f)$, all in rough agreement with observations of Wagoner on a single graphite crystal. The study of the intensity of the ESR and of its temperature dependence shows that in the initial stages of B doping some B atoms are used to neutralize the localized spin centers originally present in the undoped P33. Interlayer compound doping of the boronated samples shows additivity of the effects caused by the combined presence of the two types of doping agents. However, the processes of driving out the doping agents are not the inverse of the processes of doping. The passage of the Fermi level back and forth across the band overlap is nicely observed for Na or Li doping as a minimum in ESR absorption intensity. Analysis of the results leads to interesting conclusions concerning the band structure of the investigated carbon black and the rate of formation of holes and localized spin centers in neutron irradiation. (auth)

**44009** NEUTRON-INDUCED CHANGES IN CRYSTALLINITY AND THERMAL CONDUCTIVITY OF PYROLYTIC CARBONS. Bokros, J. C.; Price, R. J.; Koyama, K. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Carbon, 4: 293-5(July 1966). (GA-6927).

A wide variety of pyrolytic carbons were irradiated with fast neutrons at ~1000°C to a total neutron dose of 2.2 to $2.4 \times 10^{21}$ nvt. A plot of the radioinduced changes in the apparent crystallite height, $\Delta L_c$, against the original $L_c$ shows that, for the most disordered carbons, the $L_c$ values are increased by the irradiation, but, for the more crystalline carbons, the $L_c$ values are decreased. The data suggest further that the equilibrium state of disorder for these carbons is characterized by $L_c$ values near 50 Å for these irradiation conditions. The room temperature thermal resistivity change induced by the irradiation is in every case consistent with the corresponding structural change. (A.G.W.)

**44010** GAMMA-INDUCED ABSORPTION AND STRUCTURAL STUDIES OF ARSENIC BORATE GLASSES. Bishay, A. M.; Arafa, S. (Atomic Energy Establishment, Cairo. American Univ., Cairo). J. Amer. Ceram. Soc., 49: 423-30(Aug. 21, 1966).

Gamma-induced coloration in borate glasses containing As was studied to determine the effect of addition of $As_2O_3$ on the induced coloration of the alkali-borate-base glass, and the possibility of using radiation-induced coloration in studying structural changes. At concentrations of less than 10 mole % $As_2O_3$, As takes network-modifying positions and at concentrations greater than 10.0 mole % $As_2O_3$, it takes network-forming positions. Between 15.0 and 25.0 mole % $As_2O_3$, an additional change in the structure was detected. This change may be confirmed to the mode of arrangement of the structural units associated with the formation of groups or compounds. Additional studies based on infrared absorption, ultraviolet absorption edge, and density measurements, as well as the chemical analysis of the glasses, confirmed the structural changes suggested from irradiation studies. (auth)

**44011** OUTGASSING OF GLASS CAUSED BY THERMAL NEUTRONS AND GAMMA RADIATION. Altemose, V. O. (Corning Glass Works, N. Y.). J. Amer. Ceram. Soc., 49: 446-50(Aug. 21, 1966).

Prebaked evacuated glass bulbs were exposed to gamma radiation and thermal neutrons. The gases initially present in the bulb plus those evolved in a subsequent baking were measured and analyzed with a mass spectrometer. Several glasses were exposed to a gamma dosage of more than $10^7$ rads. Small quantities of $H_2$ as well as some Co, $CO_2$, and water were detected. Several B-containing glasses were exposed to more than $10^{17}$ thermal neutrons/cm$^2$. The gas evolved was almost entirely He, formed as a result of alpha-particle emission in the reaction $O^{nl} + {}^{10}_{5}B \rightarrow {}^{7}_{3}Li + {}^{4}_{2}He + 2.8$ Mev. The total quantity of He formed can be predicted from the thermal neutron dose and the B content of the glass. The role of He permeability is also discussed. (auth)

**44012** RADIATION-INDUCED ATOMIC SILVER IN PYREX AND SODIUM TETRABORATE GLASSES. Shields, L. (Univ. of Leeds, Eng.). J. Chem. Phys., 45: 2332-3 (Sept. 15, 1966).

NaCl was fused into Pyrex and $Na_2B_4O_7$ at the temperatures of mobility of the glasses. The doped glasses were irradiated with $\gamma$ rays from a $^{60}Co$ source, and electron paramagnetic resonance (EPR) spectra were obtained at 77 and 293°K. The EPR spectra of $Ag^0$ induced in Pyrex and $Na_2B_4O_7$ represented a marked contrast in environmental interaction on the atomic Ag 5s odd electron. The hyperfine splittings of $Ag^0$ in the tetraborate glass were considerably reduced relative to the free atom, and the hyperfine lines were so broad as to prevent resolution of the individual isotopic lines clearly revealed in the spectra of $Ag^0$ in Pyrex. The broad lines of $Ag^0$ in $Na_2B_4O_7$ were not resolved into hyperfine lines at higher temperatures, and at 403°K, the reduced Ag in both glasses annealed out without passing through an intermediate $Ag^{2+}$ state. (A.G.W.)

**44013** DEPENDENCE OF THE IRRADIATION BEHAVIOR OF A TEMPERED Ni-Cr-Fe ALLOY ON THE PRECIPITATION STATE. Boehm, H.; Dienst, W.; Hauck, H.; Laue, H. J. (Kernforschungszentrum, Karlsruhe). J. Nucl. Mater., 20: 87-93(July 1966). (In German).

The effects of neutron irradiation ($1.4 \times 10^{21}$ n/cm$^2$, E > 100 kev) on the mechanical properties of a precipitation hardenable Ni-Cr base alloy was investigated for various initial states of precipitation. The results established that the rise in flow stress owing to irradiation is in large measure independent of the state of precipitation and that irrespective of the state of precipitation, the strain to fracture is reduced below 4%. It was also found that the work-hardening rate $(d\sigma/d\epsilon)_{0.2}$ is reduced by irradiation, and that the tensile strength in some instances, is raised by irradiation, lowered in others. The direction of this change is not correlated in any simple way with the state of precipitation. (auth)

**44014** BEHAVIOUR OF BERYLLIUM OXIDE-BASED DISPERSION FUELS. Hilditch, R. J.; Hickman, B. S.; Rotsey, W. B.; Veevers, K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). J. Nucl. Mater., 20: 119-21(July 1966).

Dispersions containing three sizes of fuel particles, <5μ, 50μ, and 200μ were reactor-irradiated at high temperatures. Results indicate that fission fragment bombardment of the matrix in fine dispersions is less damaging than in coarse dispersions. (J.R.D.)

**44015** HIGH-TEMPERATURE EMBRITTLEMENT OF STAINLESS STEEL IRRADIATED IN FAST FLUXES. Fraser, A. S.; Birss, I. R.; Cawthorne, C. (Dounreay Experimental Reactor Establishment, Caithness, Scotland). Nature, 211: 291-2(July 16, 1966).

Irradiation in the Dounreay fast reactor, at reactor coolant temperatures (250–300°C) of tensile test pieces of a modified A.I.S.I. type 316 stainless steel was carried out to neutron doses within the range $10^{21}$ to $5 \times 10^{22}$ nvt. The effects of $^{10}B(n,\alpha)$ reactions on the ductility of the stainless steel are discussed. (M.O.W.)

**44016** FORMATION OF INTERGRANULAR VOIDS AND CRACKS IN AN IRRADIATED AUSTENITIC STEEL TENSILE-TESTED IN THE TEMPERATURE RANGE 650 DEG–850 DEG C. Sumerling, R. (United Kingdom Atomic Energy Authority, Windscale Works, Eng.). Nature, 211: 512-14(July 30, 1966).

Strip tensile specimens of 20 Cr–25 Ni–0.7 Nb steel were examined after irradiation at 750°C for 1,300 hr to a thermal neutron dose of $3.5 \times 10^{20}$ nvt. The specimens were pulled to rupture in argon at $3 \times 10^{-4}$ $sec^{-1}$ (at 750 and 850°C) and $1.7 \times 10^{-5}$ $sec^{-1}$ (at 650 and 750°C). In each instance the ductility of the irradiated specimen was reduced compared with that of the corresponding unirradiated thermal control. Formation of intergranular voids and cracks at grain boundaries are shown. (W.D.M.)

**44017** RADIATION GROWTH AND SWELLING ANALYSIS FOR CYLINDRICAL FUEL ELEMENTS DURING A POSITIVE REACTOR PERIOD. Ma, Benjamin M. Nucl. Sci. Eng., 26: 99-109(Sept. 1966).

The strain rates, strains, and stresses resulting from irradiation growth and swelling in long cylindrical solid fuel elements in unsteady-state conditions are determined analytically. From the simple diffusion equation for nonequilibrium reactor system, an exact solution for neutron flux distribution is expressed by products of Bessel function with exponential time function. From the heat conduction equation with an internal heat source in unsteady state, a solution for temperature distribution in the fuel elements is obtained. A physico-mechanical analysis for the fuel elements is carried out with some basic assumptions concerning the properties, fabrication, end and yield conditions of the fuel, and cladding materials. The figures show the combined effects of radiation growth, swelling, and time on the components of the strain rate, strain, and stress produced in the fuel elements during reactor operation. The results are based on the derived equations and the calculated results of a numerical example. (auth)

**44018** THE EFFECT OF FAST NEUTRON IRRADIATION ON THE $C_{33}$ ELASTIC MODULUS OF HIGHLY ORIENTED PYROLYTIC GRAPHITE. Summers, L.; Walker, D. C. B.; Kelly, B. T. (United Kingdom Atomic Energy Authority, Culcheth, Eng.). Phil. Mag. (8), 14: 317-23(Aug. 1966). (TRG-Report-1104; JNPC–MWP (GSG/P(65)90).

Measurements have been made of the effect of fast neutron irradiation at 150°C on the $C_{33}$ elastic modulus of very highly oriented graphite of high perfection. It is shown that the modulus is markedly decreased at high damage levels, and that this decrease can be recovered by thermal annealing. A comparison of unirradiated measurements with values appropriate to mono-crystalline graphite suggests that it is the crystal $C_{33}$ which is reduced by the large effect of irradiation on the crystal c-spacing at 150°C. The implications of this result for the interpretation of changes in the mechanical properties of polycrystalline graphite under irradiation are discussed. (auth)

**44019** THEORY OF RADIATION EMBRITTLEMENT AND RECOVERY OF RADIATION DAMAGE IN FERRITIC STEELS. Nichols, F. A. (Westinghouse Electric Corp., Pittsburgh). Phil. Mag. (8), 14: 335-42(Aug. 1966). (WAPD-T-1865).

Utilizing theories developed to explain the behavior of irradiated face-centered cubic metals, mechanisms are developed to explain neutron embrittlement and subsequent recovery of body-centered cubic metals (including ferritic steels). The proposed micro-mechanism is an adaptation of Seeger's damage theory combined with Makin's saturation effects concept and Cottrell's brittle fracture theory. It is suggested that annealing of the damage occurs by the thermally activated motion and coalescence of the damage zones as entities through surface diffusion of atoms on the zone interior surfaces. The overall zone motion is described by random-walk movement. The reasonableness of the model is demonstrated from various experimental data. (auth)

**44020** MECHANISM OF DIMENSIONAL CHANGES IN CRYSTALS OF GRAPHITES AND CARBONS UNDER FAST-NEUTRON IRRADIATION. Kelly, B. T.; Martin, W. H.; Price, A. M.; Bland, J. T. (United Kingdom Atomic Energy Authority, Culcheth, Eng.). Phil. Mag. (8), 14: 343-56(Aug. 1966). (TRG-Report-996; JNPC–MWP(GSG/P (65)79).

The accumulation of irradiation damage in graphite crystals under neutron irradiation at temperatures between 150°C and 650°C is discussed using recent ideas on nucleation of planar clusters of interstitial atoms and the collapse of lines of vacant lattice sites produced by chance sequences of atomic displacement. It is shown that a simple kinetic model based on these concepts accounts for the build-up of damage to very high levels and also, using estimated values of the dimensional changes due to various defects, accounts for the magnitude of the observed crystal dimensional changes. The model explains qualitatively the small magnitude of the physical property changes at the higher temperatures in this range in comparison with the crystal dimensional changes. (auth)

**44021** GROWTH OF INTERSTITIAL CLUSTERS IN GRAPHITE UNDER IRRADIATION. Lidiard, A. B.; Perrin, R. (Atomic Energy Research Establishment, Harwell, Eng.). Phil. Mag. (8), 14: 433-53(Sept. 1966).

After high doses of fast neutron irradiation graphite is observed to contain circular clusters of interstitial atoms, each one atomic layer thick inserted between the existing hexagonal layers of the lattice. In the electron microscope these are visible as unseared dislocation loops having Burgers vector c/2 in the c-axis direction. They grow by the diffusion to them of the mobile interstitial atoms produced by the irradiation. This diffusion-controlled growth is discussed with particular reference to the macroscopic growth of graphite crystals in the c-direction. The fractional macroscopic growth $\Delta X_c/X_c$ has been observed to exceed the fractional growth of the c-spacing, $\Delta c/c$, by an amount which increases rapidly with dose. It is shown that this behavior is understandable for a model which contains, in addition to mobile interstitials, also numerous small immobile interstitial clusters. It is argued that there is strong evidence for such defects, of high stability, from changes under irradiation in various other physical properties. (auth)

**44022** STAGE I RECOVERY OF PURE SILVER AND THE CORRESPONDENCE WITH COPPER. Wiffen, F. W.; Snead, C. L. Jr.; Kauffman, J. W. (Northwestern Univ., Evanston, Ill.). Phys. Lett., 23: 2-4(Oct. 3, 1966).

The results are reported of a high resolution experiment to determine the stage I recovery spectrum of Ag following electron irradiation near liquid He temperature. Strong similarities are found between Ag and Cu recovery behavior. (auth)

**44023** FISSION FRAGMENT DAMAGE TO CRYSTAL LATTICES: LEAD IODIDE. I. ELECTRON MICROSCOPY. Chadderton, L. T.; Torrens, I. McC. (Cambridge Univ., Eng.). Proc. Roy. Soc. (London), Ser. A, 294: 80-92(Sept. 6, 1966).

Earlier papers described the damage caused to various types of crystal by energetic fission fragments, and interpreted the electron microscope observations of damage on the basis of current theories of energy loss of charged particles, and of image contrast in the microscope. Electron microscope observations of fission fragment irradiated single crystals of lead iodide are described. This compound is heat-sensitive, and might therefore be expected to show damage through lattice excitation following the passage of a heavily ionizing energetic particle. The nature of the damage is sensitively dependent on the thickness of the crystal specimen, with tracks visible in thin crystals and a random array of dislocation loops in thicker ones. The variation in track visibility and appearance with thickness is described, and the possible mechanisms of energy loss which might account for these variations are discussed. The proximity of the crystal surfaces to the path of a fission fragment is a critical factor in determining the visible effects. Observations of damage in cadmium iodide are also discussed. The random distribution of dislocation loops in thick crystals, where surface effects are no longer influential, indicates a high mobility of the point defects created in the wake of a fission fragment by direct collision and thermal processes. Some possible mechanisms for the motion of energetic knock-ons in the lattice are suggested. (auth)

**44024** FISSION FRAGMENT DAMAGE TO CRYSTAL LATTICES: LEAD IODIDE. II. ATOMIC DISPLACEMENT. Chadderton, L. T.; Torrens, I. McC. (Cambridge Univ., Eng.). Proc. Roy. Soc. (London), Ser. A, 294: 93-111(Sept. 6, 1966).

Dynamic calculations are described which were performed for a simulated lead iodide lattice on a high speed digital computer. The principle is similar to that of earlier computations for metals by Gibson, Goland, Milgram & Vineyard. The results show that channeling of atoms in the lead iodide lattice is possible in the $\langle 10\bar{1}1 \rangle$ direction and parallel to the basal plane. It is suggested that channeling of knocked-on lattice atoms in lead iodide may be a factor in increasing considerably the mobility of point defects in an irradiated crystal and in explaining electron microscope observations of fission fragment damage. (auth)

**44025** ALLOYS UNDER IRRADIATION. A MEANS OF MAKING THEM ATTAIN VERY RAPIDLY THEIR EQUILIBRIUM STATE. Dautreppe, D. (CEN, Grenoble, France). Sci. Progr.-Nature, No. 3376, 299-304(Aug. 1966). (In French).

The use of neutron radiation for ordering the disordered state of alloys is discussed using the Fe-Ni alloy as illustration. The order-disorder transition is described and the effects of neutrons on the transition are described. The accelerated precipitation and the phase transformations induced by neutron irradiation are discussed. (J.S.R.)

**44026** EFFECTS OF RADIATION FROM $^{99}$Mo ON THE SURFACE STRUCTURE OF MOLYBDENUM OXIDE. Spitsyn, Vikt. I.; Zimakov, I. E.; Zemlyanova, L. I. (Inst. of Physical Chemistry, Academy of Sciences, USSR). Soviet Phys.-Cryst. (Engl. Transl.), 11: 284-6(Sept.-Oct. 1966).

Translated from Kristallografiya, 11: 316-20(Mar.-Apr. 1966).

The surface structure of $MoO_3$ containing varying amounts of $^{99}$Mo was examined by electron micrographs and by x-ray Laue patterns. Surface areas of the materials were also measured. It was found that the surface area of $MoO_3$ containing $Mo^{99}$ is altered by self-irradiation, and this agrees closely with electron micrographs and x-ray data. The block size of the $MoO_3$ is reduced, the surface topography is altered, and the specific surface is increased. Irradiation during formation produces much more marked surface effects than subsequent irradiation. (A.G.W.)

**44027** IRRADIATION EMBRITTLEMENT OF WELDS AND BRAZES AT ELEVATED TEMPERATURES. Martin, W. R.; Slaughter, G. M. (Oak Ridge National Lab., Tenn.). Weld. J. (N. Y.), 45: 385s-91s(Sept. 1966). (ORNL-P-2168).

Type 304 stainless steel and Inconel 600 welded and brazed joints were irradiated in the Oak Ridge Research Reactor and subjected to short-time tests at several deformation temperatures ranging from 20 to 900°C. The welds were made with the gas W-arc process using Type 308 stainless steel and ERN 62 using AWS BNi-7 filler metal (Ni-Cr-P). The base metal and welds in both materials were embrittled by irradiation but to a lesser degree in stainless steel than in Inconel. In general, the welds in both materials behaved in a manner equal to or better than the corresponding base metals. Irradiation embrittlement was also observed in the brazed joints. The toughness of the braze joints is greatly reduced at temperatures of 270°C and above for the Inconel, and 470°C and above for the stainless steel. (auth)

# PHYSICS

## General

*Refer also to abstract 43056.*

**44028** (IAE–1150) VOZMYSHCHENIYA MAGNITNYKH POVERKHNOSTEI. (Perturbation of Magnetic Surfaces). Solovev, L. S.; Shafranov, V. D. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). [1966]. 8p. Dep. mn.

The equation of magnetic surfaces $\psi(\vec{r}) = \text{const}$ is determined as a definite integral of the differential equation $\vec{B}\nabla\psi = 0$. The solution of this equation in the general case is a difficult problem, but is possible by use of a perturbation method. The magnetic field is represented by the set: 1) $\vec{B} = \vec{B}_0 + \vec{B}_1 + \vec{B}_2 \ldots.$ On assuming 2) $\psi = \psi_0 + \psi_1 + \psi_2 + \ldots$, the following set of equations is obtained by successive approximations: 3) $\vec{B}_0 \nabla \psi_0 = 0$, 4) $\vec{B}_0 \nabla \psi_1 = -\vec{B}_1 \nabla \psi_0$, and 5) $\vec{B}_0 \nabla \psi_2 = -\vec{B}_1 \nabla \psi_1 - \vec{B}_2 \nabla \psi_0$. Equations 4 and 5 have the form $\vec{B}_0 \nabla \psi = S$, where $\vec{B}_0$ and S are known, and $\psi$ can be determined. A set of toroidal magnetic surfaces can be derived, and these magnetic surfaces are perturbed by introducing the polar variables $\theta$ and $\eta$. A definite solution is obtained by assuming the absence of an average radical magnetic field, and the absence of resonance perturbations. In the presence of a wide gap the magnetic surfaces split up under the effect of resonance perturbations with $m = 2$ and 3, and form rosettes and fibers. The relative dimensions of the figures are given. (TTT)

**44029** (IS-T-99) GREEN'S FUNCTION METHOD FOR ANTIFERROMAGNETISM. Lee, Keum Hwi (Ames Lab., Iowa State Univ. of Science and Tech.). Aug. 1966. Contract W-7405-eng-82. 180p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Thesis.

Cubic antiferromagnets with isotropic, nearest-neighbor, Heisenberg interactions are studied for general spin and temperature by using two-time temperature-dependent Green's functions of the spins and the Callen's decoupling scheme. It is shown that the energy spectrum and the sublattice magnetization as functions of temperature are the solutions of a set of coupled equations. The equations are solved numerically for $S = \frac{1}{2}$ and the results compare very well with the existing theories in both high- and low-temperature limits. The Néel temperature is also calculated for general spin. Compared with other theoretical estimations, the Néel temperature obtained this way is appreciably higher for $S = \frac{1}{2}$, but approaches agreement in the large spin limit. The transverse correlation functions of the spins and the correlation length above the Néel temperature are calculated. Liu's method of calculating the longitudinal correlations function for ferromagnetism is extended to antiferromagnetism. A calculation is carried out for $S = \frac{1}{2}$ using the Callen's decoupling scheme. It is shown that the longitudinal correlation function is related to the first order response of the system to a space and time varying field. A satisfactory extension of Callen's decoupling scheme to first-order equation is found. The extended decoupling scheme leads to the following desirable results: rotational invariance of the correlation functions and susceptibilities at and above the Néel temperature and the validity of sum rules for spin operators over the same temperature range. The parallel susceptibility is also calculated as well as the internal energy and the specific heat above the Néel temperature. Numerical calculations of parallel and perpendicular susceptibilities for $S = \frac{1}{2}$ are carried out and the results are presented. (auth)

**44030** (ORNL-P-2492) THE LARGE VOLUME, HIGH UNIFORMITY MAGNETS AT THE OAK RIDGE NATIONAL LABORATORY. Gauster, W. F. (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 17p. (CONF-660921-2). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Colloquium on Intense Magnetic Fields, their Production and their Application, Grenoble, France.

Various magnet facilities at the Oak Ridge National Laboratory, each with continuous power ratings of up to 20,000 kw, generate large-volume, highly uniform magnetic fields. The special computation methods which have been employed are discussed, and the advantages and disadvantages of these water-cooled solenoids are compared with those of corresponding superconducting coil design. (auth)

**44031** MAGNETIC FLUX COMPRESSION BY MAGNETICALLY IMPLODED METALLIC FOILS. Cnare, Eugene C. (Sandia Lab., Albuquerque, N. Mex.). J. Appl. Phys., 37: 3812-16(Sept. 1966).

A 136-kJ capacitor-bank energy source was used to implode metallic foils in a theta pinch. Aluminum foils accelerated by this scheme attained a velocity of 2.3 mm/μsec and a capacitive-to-kinetic energy conversion efficiency of 23%. An upper limit for the foil velocity depended upon the foil thickness and density, together with a parameter that accounted for electrical heating of the foil. This parameter was determined in exploding wire studies. Experiments with and without auxiliary injection of magnetic flux are described. Thick, imploding foils were found to be capable of compressing enclosed magnetic flux to more than 2 MG. (auth)

**44032** TWO-STATE THEORY OF THE STRUCTURE OF $D_2O$. Davis C. M. Jr. (American Univ., Washington, D. C. Naval Ordnance Lab., Silver Spring, Md.); Bradley, D. L. J. Chem. Phys., 45: 2461-5(Oct. 1, 1966).

The two-state approach to the structure of water is applied to $D_2O$. Over the temperature range 4 to 100°C, the molar volume of both the close and open-packed structures is estimated to be approximately the same in $D_2O$ as in $H_2O$. The enthalpy difference between the two structures is found to be −2915 cal/mole in $D_2O$ compared to −2547 cal/mole in $H_2O$, indicating an increase in the hydrogen-bond strength of $D_2O$ compared to that of $H_2O$. Estimates of the relaxational thermodynamic parameters of $D_2O$ are obtained. Only those which depend on the enthalpy difference exhibit an appreciable change from the corresponding parameters in $H_2O$. (auth)

**44033** LAWS LIKE NEWTON'S. Arens, Richard (Univ. of California, Los Angeles). J. Math. Phys. (N. Y.), 7: 1341-8(Aug. 1966).

Instantaneous interaction for n particles is defined in terms of kinematic concepts only. A set of "laws," reminiscent of, but much weaker than, Newton's three laws, is formulated in solely kinematic terms. Invariance under the Euclidean group, the Galilean group, and the special Galilean group is defined, and the most general interactions satisfying the laws, and invariant under these groups, are found. It is shown that they all satisfy Newton's laws. It is shown that the interaction between moving charges cannot be instantaneous and Galilean-invariant. (auth)

**44034** STOPPING POWER OF ALUMINIUM FOR 5- TO 12-Mev PROTONS AND DEUTERONS. Andersen, H. H.; Garfinkel, A. F.; Hanke, C. C.; Soerensen, H. (Atomic Energy Commission, Research Establishment, Riso, Denmark). Kongel. Dan. Vidensk. Selsk., Mat.-Fys. Medd., 35: No. 4, 1-24(1966).

The stopping power of aluminum for 5 to 12 Mev protons and deuterons was measured by a thermometric compensation technique working at liquid helium temperature. The experimental method is described and the standard deviation of the results is found to be 0.3%. In order to obtain this accuracy one has to apply theoretical corrections for the influence of Coulomb scattering, x-rays, and δ-rays. Other possible corrections are discussed, but are found to be negligible for this combination of projectiles, energies, and target material. The results agree with published experimental results as well as with semiempirical tables. (auth)

**44035** LUMINESCENCE CAUSED BY PROTON IMPACT WITH SPECIAL REFERENCE TO THE LUNAR SURFACE. Schutten, J.; Van Dijk, Th. (FOM-Inst. for Atomic and Molecular Physics, Amsterdam). Nature, 211: 470-2(July 30, 1966).

Graphs are presented which show the luminescence of the meteorites Holbrook, Arispe, and Odessa, the lava Fuertaventura, molecular hydrogen, and willemite, under proton bombardment with an energy of 30 kev. From the results it is concluded that the luminous emissions observed from some parts of the lunar surface are not caused by impact of protons from the solar wind. (W.D.M.)

**44036** TRUE AND APPARENT TRANSFORMATIONS, CLASSICAL ELECTRONS, AND RELATIVISTIC THERMODYNAMICS. Rohrlich, F. (Syracuse Univ., N. Y.). Nuovo Cimento (10), 45B: 76-83(Sept. 11, 1966).

A comparison is made of two different relativistic generalizations of thermodynamics which have been proposed in the literature. For this purpose the distinction between true and apparent transformations proved useful and its application to the classical theory of charged particles provided physical insight. (M.O.W.)

**44037** ANTI-MATTER IN THE EARTH'S ATMOSPHERE. Nauenberg, M. (Stanford Linear Accelerator Center, Calif.); Ruderman, M. A. Phys. Lett., 22: 512-13(Sept. 1, 1966).

Calculated cross sections for interactions of an atom and an anti-atom are applied to the history of a piece of anti-matter which has entered into the earth's atmosphere. Its expected fate does not support the suggestion that the 1908 Siberian explosion can have been caused by an anti-meteorite. (auth)

**44038** DETECTION OF MAGNETIC MICROSTRUCTURES WITH CHARGED PARTICLES. Wohlleben, D. (Univ. of California, San Diego, La Jolla). Phys. Lett., 22: 564-6(Sept. 15, 1966).

The classical limit of detectability of magnetic field inhomogeneities with particles of charge q is set by the flux quantity $\Delta\varphi = h/2q$. The possibility of resolution of field structures beyond this limit is discussed. (auth)

**44039** BREMSSTRAHLUNG OF CHARGED PARTICLES IN A COULOMB FIELD. Kiriya, V. S.; Kereselidze, A. B. (Tbilisi State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSR, 43: 51-6(July 1966). (In Russian).

It was previously shown that under the influence of elastic forces and radiation reactions, an oscillator is expected to carry out a rotary motion. This is derived from a singular term that was introduced to take into consideration the law of conservation of energy. The problem was further pursued by attempting to establish whether a similar rotary effect prevails also in the case of a charged particle within a Coulomb field. The theoretical study confirmed this assumption, finding that the singular term contributes to the motion in the second and higher approximations. The results indicated that the preferred direction of the radiation at any given moment is represented by the direction of the motion of the particle. The energy emitted by the charge affects the recoil charge; interaction of the latter with the Coulomb forces results in the rotation of the perihelion of the orbit in a direction opposite to the direction of the motion of the charge. This phenomenon may be responsible for the loss of angular velocity by the stars and the sun. (TTT)

**44040** NEGATIVE REABSORPTION OF SYNCHROTRON RADIATION. Zheleznyakov, V. V. (Gorkii State Univ., USSR). Zh. Eksp. Teor. Fiz., 51: 570-8(Aug. 1966). (In Russian).

It is shown that in contrast to vacuum in which reabsorption of synchrotron radiation of a system of relativistic electrons is always positive, in a medium reabsorption may be negative provided the relativistic electron spectrum is appropriately chosen. The reabsorption frequency dependence is discussed for the case of monoenergetic and power law spectra of the emitted electrons. (auth)

## Accelerators

*Refer also to abstract 43328.*

**44041** (LA-DC-8144) CHARACTERISTICS AND EXPERIMENTAL PROGRAM FOR AN 800 Mev PROTON LINEAR ACCELERATOR. Nagle, D. E. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1966]. Contract W-7405-eng-36. 12p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A review is presented of a number of meson factory projects around the world. The operating characteristics of the Los Alamos Linear Accelerator are discussed along with characteristics of primary and secondary beams. A summary of the experimental program at Los Alamos is included. (B.G.D.)

**44042** (MURA-719) ANALYTICAL CALCULATION OF FFAG OPERATING POINTS AND ORBITS. Chien, C. S. (Midwestern Universities Research Association, Stoughton, Wis.). Apr. 28, 1966. Contract W-31-109-38-1707. 32p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Among the reports on an analytic description of particle motion in FFAG accelerators, the specific case of an integral structure machine is not treated in sufficient detail to yield quantitative conclusions starting from a set of general field coefficients. In parallel, with computer studies, an analytical investigation of the unperturbed differential equations of a charged particle motion in a steady magnetic field was made. A special technique is developed to yield the exact solution (in terms of power series) of the nonlinear equation of motion in the median plane. Based on the results of the equilibrium orbits, betatron oscillation frequencies are obtained by the application of second-order perturbation theory of quantum mechanics. An analytical method was programmed for the IBM 704 computer. A typical operating time of six minutes yields the betatron oscillation frequencies. (auth)

**44043** (RHEL-R-124) SUPPORT INSULATORS FOR HIGH VOLTAGE APPARATUS IN VACUUM. Srivastava, K. D. (National Inst. for Research in Nuclear Science, Chilton (England). Rutherford High Energy Lab.). June 1966. 10p. Dep. mn. BIS $0.60. HMSO 3s. 0d.

The performance of glass and ceramic insulators for high voltage apparatus in vacuum is described. The insulators have been tested up to 430 Kv. The work described is a part of the development program for the electrostatic inflector used on Nimrod, the 7 Bev proton synchrotron. (auth)

**44044** (AD-637068) THEORY AND DESIGN OF LINEAR ACCELERATORS (COLLECTION OF ARTICLES). Translated from pp 1-348 of Teoriya i Raschet Lineinykh Uskoritelei (Sbornik Statei), Gosatomizdat, Moscow, 1962. 449p. (FTD-MT-64-180). CFSTI $7.49 cy, $2.00 mn.

**44045** (NP-tr-1419) HIGH-VOLTAGE PERFORMANCES OF ELECTROSTATIC SEPARATORS. Coet, P. (European Organization for Nuclear Research, Geneva (Switzerland)). Translated by A. Crozy (Atomic Energy Research Establishment, Harwell, Eng.), from report MPS-Int. MU-S-66-1. 56p. Dep. mn. JCL $5.60 fs, $1.88 mf.

A discussion is presented on the high-voltage performance of electrostatic separators, especially from the point of view of long-term use (several thousands of hours). The discussion is on separators with stainless-steel electrodes and oxide-coated aluminum cathodes. (B.G.D.)

**44046** HEATED GLASS CATHODES IN ELECTROSTATIC BEAM SEPARATORS. Smith, W. A.; Mason,

T. R. (Rutherford High Energy Lab., Chilton, Eng.). Brit. J. Appl. Phys., 17: 1223-6(Sept. 1966).

The performance of Pilkington plate glass as a cathode material for a high-voltage system in vacuum was measured, and compared with that of other glass measured elsewhere. (auth)

**44047** TOWARDS THE DESIGN OF AN OBJECTIVE USING QUADRUPOLE LENSES AND CORRECTED FOR APERTURE ABERRATIONS. Dhuicq, Daniel; Septier, Albert (Faculte des Sciences, Orsay, France). Compt. Rend., Ser. B, 263: 280-3(July 25, 1966). (In French).

A group of optical systems formed from four quadrupole lenses that are stigmatic to the first order and have external gratings is designed by using for the field distribution the rectangular model approximation. Calculations on a particular case of this grouping were performed with the actual field distributions and it was found that the approximation is good. (tr-auth)

**44048** THE CONTROL OF BEAMED PARTICLES FROM THE ACCELERATOR SYSTEM OF THE SATURN SYNCHROTRON. Gabet, A. (Centre d'Etudes Nucleaires, Saclay, France). Energ. Nucl. (Paris), 8: 260-6 (June 1966). (In French).

The fundamentals, theory, construction, and the operation of the control system designed and built for the Saturn synchrotron are described. This system is composed of two control loops: A control loop in the form of rays which was designed to maintain the beam of particles on the inside of the vacuum chamber: this is the slow loop, and a control loop (in phase) which is designed to avoid rapid variations in the phase of the beamed particles in relation to the high frequency wave phase at the limits of the accelerator interval: this is the fast loop. (auth)

**44049** FIELD FUNCTIONS AND CARDINAL ELEMENTS OF MAGNET LENSES OF GLASER TYPE GAUSS FIELDS AND STEP FIELDS. Hahn, Eberhard (VEB Carl Zeiss, Jena, Ger.). Exp. Tech. Phys., 13: 375-92 (1965). (In German).

Glaser fields and step fields show on the optical axis an almost similar Gaussian behavior typical of the axis field strength of a magnetic pole shoe lens. The more they deviate from each other along an axis parallel, the greater their distance is from the axis. The complex field function assigned by the method of natural measurement determination exhibit gross differences on the real axis. For electron-optical behavior, the eigenfunction of a special eigenvalue problem is decisive in which the field function proceeds closely with the increasing lens strength. The field functions and eigenfunctions of the step fields were represented by curves for an expanded region of the lens intensity and the slit-hole behavior. Correction curves were given which permit the asymptotic cardinal elements of the Glaser fields to be converted into those of the step fields. (tr-auth)

**44050** PRELIMINARY EXPERIENCE WITH THE AUTOMATIC DEFLECTOR FOR THE ROSSENDORF CYCLOTRON. Hiekmann, S.; Schuster, H.; Trautmann, H. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Exp. Tech. Phys., 13: 447-51(1965). (In German).

For the experimental determination of the most satisfactory type of training and for the relief of the tiring training work, a device was developed and constructed that automatically performs the training of the deflector. Preliminary experiments in the practical introduction of the device were reported. (tr-auth)

**44051** PARTICLE ACCELERATOR USES BY INDUSTRY. Burrill, E. Alfred (High Voltage Engineering Corp., Burlington, Mass.). Isotop. Radiat. Technol., 3: 297-311(Summer 1966).

The 575 charged-particle accelerators in the world, besides those used for clinical therapy, are used for radiography, activation analysis, and radiation processing in industry and research, and for contract services. Their special advantages in various fields are discussed. (auth)

**44052** WAKE FIELDS OF A PULSE OF CHARGE MOVING IN A HIGHLY CONDUCTING PIPE OF CIRCULAR CROSS SECTION. Morton, P. L.; Neil, V. K.; Sessler, A. M. (Univ. of California, Berkeley and Livermore). J. Appl. Phys., 37: 3875-83(Sept. 1966). (UCRL-16740).

Expressions are presented for the electric and magnetic fields due to a pulse of charge, which may be oscillating transversely while moving down an infinitely long, highly conducting pipe of circular cross section. The expressions are evaluated at large distances from the pulse and the fields are shown to decrease algebraically in the distance behind the pulse. In the absence of transverse oscillations the longitudinal electric field varies as the inverse three-halves power of the distance; in the presence of oscillations the dominant field component is the transverse magnetic field, which decreases as the inverse one-half power. In the long-range limit the amplitude of the fields is proportional to the square root of the wall resistivity. The phase of the field associated with the oscillating pulse is shown to be the phase of the pulse at the time when it passed the point of observation. (auth)

**44053** SOME PROBLEMS OF MODERN PARTICLE ACCELERATORS. I. Keck, Chr. Kernenergie, 9: 185-90(June 1966). (In German).

Some of the problems encountered in alternating-gradient ultra-high energy accelerators, in the actual acceleration and storage in time-constant magnetic fields, as well as some new techniques and possibilities for accelerators are discussed. (G.O.Y.)

**44054** USE OF THE 3/2-RADIAL RESONANCE IN EXTRACTION FROM A SIX-SECTOR ISOCHRONOUS CYCLOTRON. Hopp, D. I.; Richardson, J. R. (Univ. of California, Los Angeles). Nucl. Instrum. Methods, 44: 277-91(Oct. 1966).

An investigation was made of the use of the $v_r = 3/2$ resonance in the extraction of particles from six-sector isochronous cyclotrons. Four pole-face geometries, two high spiral angle and two medium spiral angle, were used. The median-plane field was represented by a single harmonic. It was found that the dependence of the betatron frequency on the oscillation amplitude was very small; also, in the absence of error fields the $3/2$-resonance may easily be traversed. Upon introduction of a third harmonic gradient bump the motion becomes unstable and extraction is possible. The phase of the bump is very important and large quantitative differences in the extraction occur as the phase is changed. The well-behaved nature of the phase-space and the difference between half-integral and integral resonance extraction allows two 50% beams to be extracted, simultaneously, at two different azimuths, or with proper preparation of the center region, one 100% beam only. The extraction energy is approximately 400 Mev. (auth)

**44055** PROPERTIES OF AN INFINITE FOCUSING CHANNEL WITH SUCCESSIVE QUADRUPOLE ROTATIONS NOT EQUAL TO 90 DEG. Funsten, H. O. (College of William and Mary, Williamsburg, Va.). Nucl. Instrum. Methods, 44: 301-8(Oct. 1966).

The properties of an infinite magnetic quadrupole channel in which adjacent quadrupoles are rotated with respect to each other by an angle $\theta = 180°/n$ for $n = 3, 4, 5, \ldots$ are investigated. Operations are carried out in complete transverse plane phase space, using $4 \times 4$ matrix transformations. The results, when compared with a conventional, $\theta = 90°$, channel, show that the latter to be, in general, optimal; the $\theta \neq 90°$ channel giving higher flux only for small values of effective quadrupole length. (auth)

**44056** TRANSFORMATION OF THE PROTON SOURCE OF AN U-120 CYCLOTRON FOR NEGATIVE HYDROGEN ION PRODUCTION. Indreas, Gr.; Tauth, Th. (Inst. of Atomic Physics, Bucharest). Nucl. Instrum. Methods, 44: 353-6(Oct. 1966).

The proton source of an U-120 cyclotron was transformed to generate a $H^-$ ion current. By modifying the discharge chamber and using different ways of gas feeding, internal beams of $H^-$ were obtained of the order of one mA pulsed peak value. The modified source can deliver efficiently also positive ions, which are accelerated as usual in the cyclotron. (auth)

**44057** SKYSHINE CONSIDERATIONS FOR ACCELERATOR SHIELDING DESIGN. Distenfeld, Carl H.; Colvett, Robert D. Nucl. Sci. Eng., 26: 117-21(Sept. 1966). (BNL-9692).

The Special Measurements Group at the Brookhaven Alternating Gradient Synchrotron has conducted detailed experiments to evaluate and understand radiations emanating from the accelerator. As a part of this group study, skyshine and attenuation through Long Island sand was measured. Attenuation 90° from the apparent line source followed a half thickness of about one foot of sand through at least four decades. This corresponds to an attenuation length in sand of 80 g/cm$^2$. Skyshine was measured out to 1000 m from the target. The empirical results fit the following expression for $4.2 \times 10^{11}$ protons/sec on target: $I = (3000/r^2) \exp(-r/600)[1 - \exp(r/47)]$ where I is the dose rate in mrem/h and r is the source detector distance in meters. The source luminosity was determined, and a skyshine function was derived, based on the luminosity and the expected attenuation in air based on sand results. The empirical function was found to be within 25% of the derived expression. (auth)

**44058** TRANSVERSE RESISTIVE-WALL INSTABILITY OF EXTREMELY RELATIVISTIC BEAMS OF ELECTRONS AND POSITRONS. Ferlenghi, E.; Pellegrini, C.; Touschek, B. (CNEN, Frascati, Italy. Istituto Nazionale di Fisica Nucleare, Rome). Nuovo Cimento (10), 44B: 253-75 (Aug. 11, 1966).

The transverse resistive-wall instability is discussed with special regard to the difficulties which it may cause in the performance of colliding beam experiments. Previous results are confirmed. The treatment is based on a simplified geometry in which the motion of the beams is rectilinear. Application to a circular geometry is made possible by the introduction of conditions of periodicity. The results obtained apply to continuous as well as to bunched beams. The resisting-wall force between two colliding beams is also discussed. (auth)

**44059** NEUTRON GENERATOR ACCELERATOR TUBES MADE WITH EPOXIDE COMPOUNDS. Dolya, G. P.; Samoilov, V. P. (Inst. of Physics and Tech., Kharkov). Prib. Tekh. Eksp., No. 2, 19-22(Mar.-Apr. 1966). (In Russian).

Some neutron generator accelerator tubes with isolation rings cemented with epoxy compounds are described. The results of tests on the variation of mechanic and electric stability of these hardened compounds are presented along with an evaluation of the amount and quality (grain size) of filler desired. The selection of filler quality and percentage compositions in order to obtain the minimum variation in the coefficient of thermal expansion in both isolators and electrodes is discussed. It is concluded that epoxy compounds can compete with ceramics and other materials for this purpose. (G.O.Y.)

**44060** METHOD FOR IMPROVING MAGNETIC SHIELDING EFFICIENCY. Artemeva, Z. I.; Shorin, K. N. (Inst. of Physics, Moscow). Prib. Tekh. Eksp., No. 3, 190-2(May-June 1966). (In Russian).

The results of an investigation of shielding an accelerator tube from the Earth's magnetic field by hysteresisless soft-steel torus rings are reported. In a model study, 10 rings of 260 mm diameter had a shielding factor of 1.65 to 2.0 when the constant field was held within 0.4 to 3.5 Oe; when a strong damping-amplitude a-c field was added (the hysteresisless magnetization), the shielding factor increased to 20 to 14. In the experiment, a 2.2-m-long accelerating tube with an initial electron energy of 5 to 8 kev and final energy of 800 kev was shielded by the steel rings which reduced the transverse earthmagnetic component of 0.45 Oe down to 0.02 Oe (except for the edges where the field was 0.1 Oe). (ATD)

**44061** HIGH-ENERGY ELECTROMAGNETIC CONVERSION PROCESSES IN INTENSE MAGNETIC FIELDS. Erber, Thomas (Illinois Inst. of Tech., Chicago). Rev. Mod. Phys., 38: 626-59(Oct. 1966).

General characteristics of magnetic bremsstrahlung (synchrotron radiation) are derived on the basis of calculations utilizing exact relativistic matrix elements. The spectral and total energy losses may be described by compact expressions incorporating radiative and quantum corrections. Comparisons of the relative efficacy of matter and magnetic fields as bremsstrahlung radiators indicate that even under relatively conservative conditions the natural conversion rates associated with the magnetic process (i.e., $9.6 \times 10^3$ Bev/mm) tend to favor this type of conversion over ordinary bremsstrahlung. Discussions of a similar scope—including detailed calculations, and comparisons with the corresponding processes in material media—are also carried out for magnetic pair production, direct and indirect trident cascades, and magnetic photon splitting. Circumstances peculiar to a class of external field radiative processes involving cooperative vacuum polarization corrections are illustrated by a discussion of magnetic Čerenkov radiation. (auth)

**44062** ACCELERATOR CALIBRATION ENERGIES. Marion, Jerry B. (California Inst. of Tech., Pasadena). Contract Nonr-220(47). Rev. Mod. Phys., 38: 660-8(Oct. 1966).

The absolute measurements of nuclear reaction energies appropriate for calibration purposes are critically reviewed and recommended values are given. A sufficient number of points are now known with precision to permit the calibration of proton beams up to 60 Mev. (auth)

**44063** PERMANENT-MAGNET MULTIPOLAR LENS WITH VARIABLE FOCUSING. Audoin, C.; Septier, A. (Institut d'Electronique, Orsay, France). Rev. Phys. Appl., 1: 95-6(June 1966). (In French).

It is shown that by modifying the magnetic circuit structure of permanent-magnet multipolar lenses by means of a magnetic shunt, it is possible to vary the magnetic flux density in the gap without altering the field symmetry. Results obtained with an hexapolar test lens are described. (auth)

**44064** USE OF CONFORMAL MAPPING TO IMPROVE FIELD UNIFORMITY OF ELECTROMAGNET. Fuller, F. L. (Grumman Research Dept., Bethpage, N. Y.). Rev. Sci. Instrum., 37: 1330-2(Oct. 1966).

Conformal mapping is used to determine the cross section of a shim in order to improve the uniformity of the field in the air gap of a magnet. Experimental measurements on a laboratory electromagnet demonstrate the improvement in field uniformity. (auth)

**44065** BEAM STEERING WITH QUADRUPOLE AND WITH RECTANGULAR BOX MAGNETS. Draper, James E. (Univ. of California, Davis). Rev. Sci. Instrum., 37: 1390-4(Oct. 1966). (UCD-CNL-46).

The exact field configuration in the aperture of an asymmetrically excited electric or magnetic quadrupole lens is derived. The resulting effectiveness as a combined focusing and steering device for particle beams is analyzed, and the limitations are explored. Simple expressions are obtained for the steering effect. These results are compared to the effectiveness of a rectangular array of current sheets and iron as a steering device. The latter is shown to be superior in many cases. (auth)

**44066** SIMPLE BAKEABLE THIN FOIL VACUUM WINDOW. Edgecumbe, J. (Stanford Linear Accelerator Center, Stanford, Calif.). Rev. Sci. Instrum., 37: 1419 (Oct. 1966).

Thin foil vacuum tight windows of low Z material are used at high-energy accelerators whenever the beam passes from vacuum to air. The use of low Z materials ensures negligible scattering of the primary beam. A thin foil window is described which is bakeable to 200 or 250°C for use in an ultrahigh system designed to measure the secondary emission from low density alkali halides at relativistic energies. (B.G.D.)

**44067** PARTICLE ACCELERATOR UTILIZING COHERENT LIGHT. Lohmann, Adolf W. (to International Business Machines Corp.). U. S. Patent 3,267,383. Aug. 16, 1966. Filed May 27, 1963.

The design of an accelerator which accelerates particles using electromagnetic waves in the infrared and visible frequency ranges is given. Fields of a much higher potential can be obtained thereby allowing the accelerator to be much shorter. The interaction between the light and the particles takes place in a vacuum thus eliminating electron scattering from the gas molecules of an accelerator previously described. (J.F.P.)

**44068** ION ACCELERATOR. Youmans, Arthur H.; Hopkinson, Eric C. (to Dresser Industries Inc.). Canadian Patent 738,074. July 5, 1966.

A single power supply provides both the ion-producing and ion-accelerating voltages which are connected in series. The electrodes are arranged so as to maintain current flow in both parts of the accelerator. A single belt-type electrostatic generator is used and overall design of the device is described. (F.S.A.)

## Astrophysics and Cosmology

*Refer also to abstracts 43550, 44282, and 44471.*

**44069** (IPPJ-44(J)) REPORT OF 1965 NAGOYA MEETING ON SPACE PLASMA PHYSICS. (Institute of Plasma Physics, Univ. of Nagoya (Japan)). Dec. 1965. 109p. Dep. mn.

Information is presented on solar plasma and its interaction with the magnetic field of the earth. The following earth-related phenomena and their relation to the solar wind are discussed: hydromagnetic instabilities, magnetospheric boundary, radiation belts, ionospheric layers, and related atomospheric disturbances. The evolution and dynamics of radio galaxies are considered in the framework of relativistic cosmology. (J.H.M.)

**44070** (LA-DC-7885) DEPENDENCE OF NUCLEOSYNTHESIS ABUNDANCE CALCULATIONS ON THE MASS LAW. Seeger, Philip A. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1966]. Contract W-7405-eng-36. 32p. (CONF-660817-4). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From International Symposium on Why and How Should We Investigate Nuclides Far Off the Stability Line, Lysekil, Sweden.

A qualitative model of the r-process (i.e., stellar nucleosynthesis by neutron capture on a rapid time scale) is presented. A semi-empirical mass law is used to estimate neutron binding energies and $\beta$-decay probabilities for isotopes which are as much as 50 mass units heavier than the valley of $\beta$-stability. Peaks in the solar-system isotopic abundance curve indicate the influence of shell-structure magic numbers in these heavy isotopes; simple parabolic terms in the mass law, if determined independently from deformations, were found adequate to reproduce the observed abundances. However, it is found that additional mass law terms, which greatly improve the fit to known masses near $\beta$-stability, often override the shell-effects terms in the super-heavy region, and destroy the calculated abundance peaks. Several examples of mass laws and the resulting abundance calculations are considered. (auth)

**44071** PHOTOELECTRIC SPECTROPHOTOMETRY OF QUASI-STELLAR SOURCES. Oke, J. B. (Carnegie Institution of Washington, [D. C.]. California Inst. of Tech., Pasadena). Astrophys. J., 145: 668-83(Sept. 1966).

A photoelectric spectrum scanner was used to measure absolute spectral energy distributions of a number of quasi-stellar radio sources. Most of the observations were made between $\lambda$ 3300 and $\lambda$ 6000, but for 3C 286 and CTA 102 observations extend to nearby $\lambda$ 9000. In these, the infrared measures indicate the presence of the [O III] lines $\lambda$ 4959 and $\lambda$ 5007, and H$\beta$ or H$\delta$, and confirm previously published redshifts. It is probable that $1 + z = 2.40$ for 3C 446. The [C III] line $\lambda$ 1909 is not detected in 3C 9. When the whole visual continuous spectrum of 3C 9 is taken into account, there is no evidence for a drop in the continuum below Ly-$\alpha$, so that the estimate of the amount of neutral hydrogen in intergalactic space made by Gunn and Peterson is only an upper limit. The spectral energy distributions of CTA 102, 3C 245, and 3C 446 show two very distinct and in two cases radically different slopes. Absence of a detectable Balmer jump in 3C 48 and CTA 102 indicates that at the longer wavelengths the continuous spectrum is non-thermal in character and may possibly be synchrotron radiation; this is probably also the case in 3C 245 and 3C 446. The continuous spectrum of 3C 9 can be fitted either by a thermal bound-free plus free-free hydrogen spectrum or by a synchrotron model. The strength of Ly-$\alpha$ suggests that most of the continuum is not produced by a hot hydrogen gas. The flat portions of the spectra of 3C 273, CTA 102, 3C 446, as well as the whole observed spectrum of 3C 286, could be produced either by the synchrotron mechanism or by a hot hydrogen nebula; the present observations do not allow a choice to be made. From the strength of H$\beta$ in 3C 48 it is found that a Balmer jump in emission of 0.3 mag should occur if $T_e = 16000$°K. The observations do not show such a jump and suggest a higher electron temperature. A comparison of the strengths of Ly-$\alpha$ and $\lambda$ 1550 of C[IV] in 3C 9 gives $T_e = 20000$°K, provided a significant fraction of all carbon atoms are in the form of $C^{3+}$ and the carbon abundance relative to hydrogen is not very different from that in the sun. (auth)

**44072** PREDICTED AND OBSERVED FEATURES OF QUASI-STELLAR SOURCES. Bahcall, John N. (California Inst. of Tech., Pasadena). Astrophys. J., 145: 684-96(Sept. 1966).

Some observed features of quasi-stellar sources are correlated in a way that enables one to predict with simple models the relative strengths of the Lyman lines and the optical depth of the nebulae beyond the Lyman continuum. The relative strengths of the Lyman lines are calculated first for an optically thin nebula, and then expressions are derived for the amount by which the intensities of the more energetic Lyman lines are attenuated in an optically thick nebula. The probability that resonant radiation escapes from an optically thick nebula is estimated with a diffusion equation and is found to be much larger than previously estimated if some emission originates near the surface of the nebula. Three possible causes for the observed emission widths are discussed, and it is concluded that the most likely cause is random motions of gas clumps or filaments. A suggestion due to Schmidt for constructing models of quasi-stellar sources that are optically thin to electron scattering is developed quantitatively. The average degree of ionization of the hydrogen in a quasi-stellar source and the optical depth beyond the Lyman continuum are expressed in terms of the unknown ionizing flux. A plausible guess for the strength of the ionizing flux indicates that some quasi-stellar sources may be optically thin beyond the Lyman continuum. A possible correlation is suggested between the age (and luminosity) of the nebula of a quasi-stellar source and the value of its optical depth beyond the Lyman continuum. Several other observational consequences of our discussion are also described. In particular the predictions are shown to depend sensitively on whether or not quasi-stellar sources are, like the nuclei of Seyfert galaxies, surrounded by an appreciable amount of neutral hydrogen. (auth)

**44073** ROTATION OF THE SOLAR CORONA. Pneuman, G. W. (General Motors Defense Research Labs., Santa Barbara, Calif.). Astrophys. J., 145: 800-5(Sept. 1966).

The angular velocity of the solar corona is determined as a function of radial distance from the sun. The influence of the solar wind, a radial magnetic field, and viscosity are included. For magnetic fields of surface strength ranging from 0 to 1 gauss, corotation exists up to a maximum of about 3 R⊙. In general, the angular velocity drops sharply in the neighborhood of the point where the solar-wind velocity overtakes the Alfvén speed. When no magnetic field is present, the angular velocity near the sun is close to that predicted by conservation of angular momentum but falls progressively lower than this value as the distance from the sun increases. (auth)

**44074** SOME EFFECTS OF THE STRONG INTERACTIONS ON THE PROPERTIES OF NEUTRON-STAR MATTER. Wolf, Richard A. (California Inst. of Tech., Pasadena). Astrophys. J., 45: 834-41(Sept. 1966).

A modified phase-shift method is used to estimate the chemical potentials of neutrons and protons in neutron-star matter. The computed chemical potentials are used to calculate the densities of protons, electrons, and muons in neutron-star matter containing no strange particles. The strong interactions increase the number densities of protons and electrons by as much as a factor of 5 over the values calculated by the free-particle approximation. The clustering of protons into "nuclei" is considered, and it is shown that "nuclei" are likely to form at densities less than about $^3/_4$ nuclear density. The question of superfluidity in neutron-star matter is discussed. The effects of strong interactions on neutrino emission are also considered, and an expression is given for the rate of the reaction $n + n \rightarrow n + p + e^- + \bar{\nu}$ and its inverse. (auth)

**44075** THE COMPLETE RAYLEIGH-SCATTERED FIELD WITHIN A HOMOGENEOUS PLANE-PARALLEL ATMOSPHERE. Mullikin, T. W. (Purdue Univ., Lafayette, Ind.). Contract AF 49(638)-1700. Astrophys. J., 145: 886-931(Sept. 1966).

Previous work on scalar transfer equations is extended to the Rayleigh polarization equations in a homogeneous atmosphere. It is shown that Chandrasekhar's results for scattering and reflection functions are merely the specialization to the boundary of formulas which hold within an atmosphere. This expresses the solution to this problem at any optical depth in an atmosphere of any optical thickness in terms of scalar functions for which there already exists an efficient and accurate computer program. Various asymptotic formulas of a relatively simple form are also obtained. The nonlinear equations which express the heuristic principles of invariance follow rigorously from the transfer equation by Laplace transform methods. Solutions to these nonlinear equations are obtained and give intensities within an atmosphere expressed as nonlinear combinations of solutions to the linear integral equations. (M.O.W.)

**44076** TERMINATION OF THE PROTON-PROTON CHAIN VIA THE $^7Be(p,\gamma)^8B$ REACTION. Parker, Peter D. (Brookhaven National Lab., Upton, N. Y. Yale Univ., New Haven). Contract AT(30-2)-Gen-16. Astrophys. J., 145: 960-1(Sept. 1966). (BNL-10331).

In stars burning hydrogen via the proton-proton chain, once $^3He$ has been produced via the reactions $^1H(p,\beta^+\nu)^2D(p,\gamma)^3He$, the chain can be terminated by the following sequence, $^3He(\alpha,\gamma)^7Be(p,\gamma)^8B(\beta^+\nu)^{8*}Be(\alpha)^4He$. Cross sections were measured at eight proton energies between 483 and 1932 kev. These cross sections, with the effect of the Coulomb barrier removed, are described. (M.O.W.)

**44077** HALOGENS IN CHONDRITES. Reed, George W. Jr.; Allen, Ralph O. Jr. (Argonne National Lab., Ill. Univ. of Chicago). Geochim. Cosmochim. Acta, 30: 779-800(Aug. 1966).

Cl, Br, and I contents in samples of the several classes of chondrites have simultaneously measured by activation analysis. Auxiliary information derived from these analyses confirms U and Te concentrations and I/Te ratios reported in the literature. For the ordinary (bronzite and hypersthene), pigeonite, enstatite, and carbonaceous chondrites the respective Cl contents are 4–90, 120, 516, and 280 ppM; the Br contents are 0.05–0.2, 2.0, 1.5–6.5, and 2.0–11.0 ppM and the I contents are 0.05–0.08, 0.16, 0.07–0.47, and 0.23–1.21 ppM. Cl and Br are positively correlated; most chondrites fall on correlation lines with Cl/Br weight ratios between 20 and 100. Br and I exhibit a simple correlation; most meteorites fall near a line with a Br/I weight ratio of about 1. Leaching experiments yielded results that supported these interhalogen relations, and also gave the degree of water solubility of the halogens: Cl < Br ~ I ~ Te. Abundances derived from the data support current thinking that the Type I carbonaceous chondrites have best retained a primordial complement of solar system matter. The astrophysical and meteoritic abundances of chlorine based on oxygen agree reasonably well, 22 vs ~9 atom Cl/$10^4$ atom O; whereas the abundance based on Si differ greatly, $1.5 \times 10^5$ vs 2800 atom Cl/$10^6$ atom Si. (auth)

**44078** MARINER 2 OBSERVATIONS OF THE SOLAR WIND. 1. AVERAGE PROPERTIES. Neugebauer, Marcia; Snyder, Conway W. (California Inst. of Tech., Pasadena). J. Geophys. Res., 71: 4469-84(Oct. 1, 1966).

The properties of the positive-ion component of the solar wind observed during the four months of the Mariner 2 flight to and past Venus in 1962 are summarized. The protons' average velocity and temperature were approximately 500 km/sec and $1.7 \times 10^5$°K, respectively. Several streams of hot, high-velocity plasma were observed to recur at 27-day intervals, with peak velocity and temperature value of ~830 km/sec and $9 \times 10^5$°K. One of these streams probably existed for at least 18 months. Between streams the velocity dropped as low as 307 km/sec, while the temperature was $\sim 3 \times 10^4$°K. Near 1 AU the average number density was approximately 5 protons/cm$^3$. The density was usually highest at the leading or western edge of each stream, with a maximum value of ~80 protons/cm$^3$. Otherwise, the density varied inversely with the plasma velocity. The ions' velocity, temperature, and density were calculated from ~35,000 energy/charge spectrums by fitting data to isotropic Maxwell-Boltzmann distributions in a reference frame moving away from the sun at the solar-wind velocity. A model in which the protons and $\alpha$ particles have equal thermal velocities gives a better fit to the observed spectrums than does an equal-temperature model. The spectrums usually had high-energy tails, which became more pronounced at the higher plasma velocities. The velocity, temperature, and high-energy tail were not strongly dependent on distance from the sun, whereas the density varied approximately as the inverse square of this distance. (auth)

**44079** MASS YIELD SPECTRUM OF COSMIC-RAY-PRODUCED XENON. Rowe, M. W.; Bogard, D. D.; Kuroda, P. K. (Univ. of Arkansas, Fayetteville). J. Geophys. Res., 71: 4679-84(Oct. 1, 1966).

Results of a study of the isotopic composition of xenon have indicated that the two Ca-rich achondrites that comprise in toto the group of diopside–olivine achondritic meteorites (the nakhlites) contain only a very small amount of excess fission-produced xenon. Thus it appears possible to obtain a relatively "pure" isotopic spectrum of xenon isotopes resulting from cosmic-ray spallation reactions. The mass yield spectrum of spallation xenon normalized to $^{126}Xe$ is found to be $^{124}Xe : ^{126}Xe : ^{128}Xe : ^{130}Xe : ^{131}Xe : ^{132}Xe = 0.57 : 1.00 : 1.53 : 0.86 : 2.5 : 0.60$. The values are compared with current estimates by other workers. It is proposed on the basis of the xenon isotopic abundance that Nakhla and Lafayette are identical and do not represent independent falls. (auth)

**44080** CHARGE ASYMMETRY AND ENTROPY OF A HOT UNIVERSE. Zel'dovich, Ya. B.; Novikov, I. D. JETP Lett. (USSR)(Engl. Transl.), 4: 80-2(Aug. 1, 1966).

Translated from Zh. Eksperim. Teor. Fiz., Pis'ma Redakt., 4: 117-20(Aug. 1, 1966).

An explanation is given for the earlier found small charge asymmetry of the universe at high baryon density. (M.O.W.)

**44081** RADIO ASTRONOMICAL DETECTION OF HELIUM. Lilley, A. E.; Palmer, P.; Penfield, H.; Zuckerman, B. (Harvard Coll. Observatory, Cambridge, Mass.). Nature, 211: 174-5(July 9, 1966).

The detection of three radio lines arising from transitions between highly excited states of neutral helium ($^4$He) is reported. The observations were made with the 60-ft Howard telescope during Feb.–Apr. 1966. The observed helium lines result from transitions of the n + 1 → n type between states 160 and 159, 159 and 158, and 157 and 156. Line profile is given. (W.D.M.)

**44082** IS GRAVITATIONAL COLLAPSE REALLY IRREVERSIBLE? Israel, Werner (Univ. of Alberta, Edmonton, Can.). Nature, 211: 466-7(July 30, 1966).

In the face of difficulties in the cosmological interpretation of the large red-shifts of quasi-stellar sources, it is suggested that a naive application of Newton's theory will account in a perfectly natural way for all the major observed features of quasi-stellar sources. A short critical examination is made of the question of whether or not general relativity predicts the irreversibility of gravitational collapse. (W.D.M.)

**44083** APPEARANCE OF RELATIVISTICALLY EXPANDING RADIO SOURCES. **Rees, M. J. (Cambridge Univ., Eng.). Nature, 211: 468-70(July 30, 1966).**

It is suggested that the central parts of some radio sources may expand with relativistic velocities which could have a decisive influence on the observable properties of these sources. A flux from a radio source expanding with relativistic velocity can change sufficiently rapidly to account for the variations observed in some sources, even if they are at cosmological distances. A related relativistic effect would imply that the ages of some types of radio sources may be significantly less than the usual estimates. (W.D.M.)

**44084** ABSORPTION OF HIGH-ENERGY GAMMA-RAYS WITHIN QUASARS AND OTHER RADIO SOURCES. **Jelley, J. V. (Atomic Energy Research Establishment, Harwell, Eng.). Nature, 211: 472-5(July 30, 1966).**

The conspicuous absence of positive results in the many attempts in recent years to detect high-energy gamma rays from selected objects in the universe has led many to question the transparency of space to such radiations. The cases of $\gamma$-ray absorption considered so far have all been concerned with the attenuation in the relatively weak photon fields between the earth and the source. It is pointed out that the same absorption process may be significant within the sources themselves. The potential sources of high-energy radiations are in general also intense sources of radiation of low quantum energy. Source absorption in 3C273, Crab nebula, and Galaxy M87 is discussed. (W.D.M.)

**44085** EXPECTED NUMBER OF BLUE-SHIFTS AND RED-SHIFTS OF EJECTED SOURCES. **Faulkner, John (California Inst. of Tech., Pasadena. Peterhouse, Cambridge, Eng.); Gunn, James E.; Peterson, Bruce A. Nature, 211: 502-3(July 30, 1966).**

It has recently been suggested by Arp (Science, 151: 1214 (1966)) that the quasi-stellar radio sources are objects that have been ejected by relatively nearby peculiar galaxies. If their large red shifts are due to the Doppler effect, it is shown that one would, in fact, expect to see many more objects with spectral shifts towards the blue than those with shifts towards the red. (W.D.M.)

**44086** MODEL OF THE HIGH-ENERGY PHASE OF SOLAR FLARES. **Sturrock, P. A. (Stanford Univ., Calif.). Nature, 211: 695-7(Aug. 13, 1966).**

A model is proposed which seems to account for the high-energy phenomena which some flares exhibit; radio bursts, proton acceleration, and the ejection of plasma clouds which may later produce a geomagnetic storm. It is suggested that the relevant magnetic field configuration for coronal streamers is one which is topologically identical with the "double-barrelled" tail of the Earth's magnetosphere and can be termed a "bipolar flux tube." (M.H.R.)

**44087** MODEL OF QUASI-STELLAR RADIO SOURCES. **Sturrock, P. A. (Stanford Univ., Calif.). Nature, 211: 697-700(Aug. 13, 1966).**

Earlier proposals that the explosions of galaxies and of quasars, leading to radio clouds, might be interpreted as "galactic flares" could not then be developed. The model for the high-energy phase of solar flares [Nature, 211: 696-8(Aug. 13, 1966)] makes it possible to construct a more detailed model of quasi-stellar objects. An open primeval magnetic field is assumed, with the nucleus of the quasar coupled magnetically to intergalactic space. Among other things, this model makes it possible to explain why the formation of a small heavy object has not been inhibited by angular momentum: the "open" magnetic field configuration provides a mechanism for retaining a low angular velocity during condensation by transferring angular momentum from the inner regions to the outer regions. According to this model, a radio galaxy would evolve from each quasar. (M.H.R.)

**44088** COUNTS OF RADIOSOURCES IN THE REVISED 3 C CATALOGUE. **Veron, P. (Observatoire de Meudon, France). Nature, 211: 724-5(Aug. 13, 1966).**

Using recent accurate radio positions, a systematic search was made to identify any objects in the field of the radiosources in the Revised 3C Catalogue on the Palomar Sky Survey prints and plates. Many positive and tentative new identifications were made. It is suggested that almost all the 'empty field' and 'non-identified' objects are quasars rather than radiogalaxies. (M.H.R.)

**44089** QUARKS AND COSMOLOGY. **Saslaw, William C. (Cambridge Univ., Eng.). Nature, 211: 729-30 (Aug. 13, 1966).**

Some suggestions are made as to the part that quarks may play in cosmology. It is possible that a low observed abundance of quarks may impose much more stringent limits on the anisotropy of the universe than can be obtained from investigations of radio- and quasi-stellar objects. The discovery of quarks and their properties may provide further constraints on theories of the early stages of an expanding universe. (M.H.R.)

**44090** IDENTIFICATION OF RADIO GALAXIES AND QUASI-STELLAR OBJECTS. **Bolton, J. G. (CSIRO, Sydney). Nature, 211: 917-20(Aug. 27, 1966).**

Thirty-three radio sources were identified between declinations 20° and −30°. Their distribution in celestial coordinates and the identification status of each source is given. (M.O.W.)

**44091** RESOLUTION OF X-RAY SOURCES AT LOW GALACTIC LONGITUDE. **Fisher, Philip C.; Jordan, Willard C.; Meyerott, Arthur J.; Acton, Loren W.; Roethig, Douglas T. (Lockheed Palo Alto Research Labs., Calif.). Nature, 211: 920-3(Aug. 27, 1966).**

An Aerobee rocket fitted with a roll-stabilized attitude control system (ACS) was used and flown from the White Sands Missile Range. The ACS was programmed such that two differently oriented x-ray detectors could make two short scans approximately parallel to the galactic equator. Pulse heights of individual events in the x-ray detectors, detector scan rates, and stellar signals from the aspect photometers were all telemetered to the ground. A discussion is presented of the results. (M.O.W.)

**44092** EVIDENCE ON THE EVOLUTIONARY CHARACTER OF THE UNIVERSE DERIVED FROM RECENT RED-SHIFT MEASUREMENTS. **Longair, M. S. (Cambridge Univ., Eng.). Nature, 211: 949-50(Aug. 27, 1966).**

Hoyle and Burbidge recently examined the red shifts of a number of quasistellar radio sources and plotted their radio flux densities (S) against red shift (z); they conclude that the results are inconsistent with a cosmological interpretation of these red shifts. It is shown that this conclusion is not valid, and that, indeed, the observed relationship between S and z provides valuable new information on the evolutionary nature of the universe. (M.O.W.)

**44093** HIGH-ENERGY GAMMA-RAYS AS A MEANS OF INVESTIGATING SOLAR FLARES. **Bland, C. J. (Univ., Milan. CNR-INFN, Milan). Nuovo Cimento (10), 44B: 427-33(Aug. 11, 1966).**

In certain solar flares a large proportion of the energy emitted is in the form of fast particles. These particles include electrons, protons, and possibly heavier atomic nuclei. The interaction of the electron component with solar material is revealed by the radio outbursts accompanying certain flares. Various authors have concluded that the interaction of the solar protons at their point of production with solar material could lead to the generation of high-energy gamma-rays (above 50 Mev) due to the formation of neutral pions in nuclear interactions. It is shown here that the resultant gamma-ray energy spectrum will have a maximum at an energy which depends on the direction of motion of solar protons with respect to solar material. The position of this maximum is shown to be relatively independent of the energy spectrum of the incident solar protons. The experimental method to be used to reveal this effect is discussed and plans to perform such an investigation are mentioned. (auth)

**44094** QUARK MODEL FOR QUASARS. Blatt, J. M. (Hebrew Univ., Jerusalem. Weizmann Inst. of Science, Rehovoth, Israel); Gutfreund, H. Phys. Lett., 23: 94-6 (Oct. 3, 1966).

The combination of quarks of charge-$\frac{1}{3}$ into protons may account for the energy output, time fluctuations, and other properties of quasi stellar radio sources. Observational tests are suggested. (auth)

**44095** EXTENDED SOURCE OF ENERGETIC COSMIC X RAYS. Boldt, Elihu; McDonald, Frank B.; Riegler, Guenter; Serlemitsos, Peter (Goddard Space Flight Center, Greenbelt, Md.). Phys. Rev. Lett., 17: 447-50 (Aug. 22, 1966).

Evidence for an extended source of x rays in a region near the direction of the north galactic pole is reported. (B.G.D.)

**44096** RADIO PROPAGATION IN THE SOLAR GRAVITATIONAL FIELD. Muhleman, D. O.; Johnston, I. D. (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Lett., 17: 455-8(Aug. 22, 1966).

A relation is derived for computing the combined effect on radio propagation in a simple plasma in the presence of a weak gravitational field. (B.G.D.)

**44097** SYMMETRY BETWEEN PARTICLE AND ANTIPARTICLE POPULATIONS IN THE UNIVERSE. Chiu, Hong-Yee (Goddard Space Flight Center, New York. State Univ. of New York, Stony Brook). Phys. Rev. Lett., 17: 712-14(Sept. 26, 1966).

It is shown that, according to currently accepted world models and the observed microscopic properties of matter, had the total number of particles and antiparticles been equal at the time when the universe was still in a highly condensed state, all but a fraction of particle pairs would have annihilated into photons or $\pi$ mesons as the universe expanded, and the radiation energy density of the present universe would have been much greater than what is observed. (B.G.D.)

**44098** SHOCK WAVES IN THE INTERPLANETARY MEDIUM. Simon, M.; Axford, W. I. (Cornell-Sydney Univ. Astronomy Center, Ithaca, N. Y.). Planet. Space Sci., 14: 901-8(Sept. 1966).

A similarity solution is given for spherically-symmetric, radial flow due to a point source, which is an idealization of the disturbance produced in the interplanetary medium by a sudden expansion of the solar corona following a flare. The solution illustrates the formation of forward-reverse shock pairs, essentially as postulated by Sonett and Colburn. The distortion of the interplanetary magnetic field by the disturbance is also discussed briefly. (auth)

**44099** INTEGRATION OF THE EQUATIONS OF STELLAR STRUCTURE. Paczynski, Bohdan. Postepy Astron., 14: 3-17(Mar. 1966). (In Polish).

A description of the methods used to construct stellar models is given. In particular the Henyey's method of integration of the equations of stellar structure is described and advantages of this method are explained. (auth)

**44100** SECOND HELIUM FLASH AND AN ORIGIN OF CARBON STARS. Sugimoto, Daiichiro; Yamamoto, Yoshiaki (Univ. of Nagoya, Japan). Progr. Theoret. Phys. (Kyoto), 36: 17-36(July 1966).

The development of the shell helium flash or the second helium flash is studied. This phenomenon sets in after a less-massive star has reached the giant branch of a globular cluster, having left the horizontal branch, i.e., after the main helium-burning phase has made a partially degenerate carbon—oxygen core. Temperatures at the helium-burning shell are found to reach higher values than in the first helium flash at the center. This results in a more extended intermediate convection zone in the helium region. Even after the peak of the flash has passed, the helium convection zone is found to extend continually, until its top reaches the bottom of the hydrogen-rich envelope. The mixing of hydrogen into the helium zone may be triggered by the overshoot of convection and/or by the Rayleigh-Taylor instability. Once the mixing has begun, it is accelerated exponentially because of the nuclear energy generation from the mixed hydrogen, until the top of the helium convection zone reaches the bottom of the surface convection zone and large scale mixing lowers the temperature. Carbon and other products of nucleosynthesis can be transported to the stellar surface. It is suggested that an appreciable fraction of stars may be carbon stars in the very tip of the giant branch of globular clusters. (auth)

**44101** X-RAY SOURCES OF SOLAR FLARES. Kawabata, Kin-aki (Tokyo Univ.). Rep. Ionosphere Space Res. Jap., 20: 118-27(1966).

From a statistical study, it is shown that solar soft x-ray enhancements correlate with microwave long-enduring bursts. Because an x-ray event on September 4, 1960, is associated with a flare which occurred at a sunspot group in the far-side hemisphere, the x-ray source must be located in the coronal region. The x-ray sources are probably loops as observed by Saito and Billings. A model of the x-ray source is briefly discussed. (auth)

**44102** MECHANISM OF SOLAR FLARES. Sakurai, Kunitomo (Kyoto Univ.). Rep. Ionosphere Space Res. Jap., 20: 233-6(1966).

The associations of solar flares with sunspots, cosmic rays, and Type IV radio bursts are discussed. The structure of sunspot magnetic fields in and near the flare region is shown, deduced from the characteristics of Type IV radio bursts. During the development of solar flares, the variation of sunspot magnetic fields consists of two fundamental processes; namely, the expansion and compression of two different magnetic flux tubes due to the interchange of them. Observed phenomena associated with each of these two processes are summarized. (J.H.M.)

**44103** DOPPLER INTERPRETATION OF QUASAR RED SHIFTS. Zapolsky, Harold S. (Univ. of Maryland, College Park). Science, 153: 635-8(Aug. 5, 1966).

The hypothesis that the quasistellar sources (quasars) are local objects moving with velocities close to the speed of light is examined. Provided there is no observational cutoff on apparent bolometric magnitude for the quasars, the transverse Doppler effect leads to the expectation of fewer blue shifts than red shifts for an isotropic distribution of velocities. Such a distribution also yields a function N(z), the number of objects with red shift less than z which is not inconsistent with the present data. On the basis of two extreme assumptions concerning the origin of such rapidly moving sources, curves of red shift were plotted against magnitude. In particular, the curve obtained on the assumption that the quasars originated from an explosion in or nearby our own galaxy is in as good agreement with the observations as the curve of cosmological red shift plotted against magnitude. (auth)

**44104** IMPLANTATION IN INTERPLANETARY DUST OF RARE-GAS IONS FROM SOLAR FLARES. Tilles, David (Smithsonian Astrophysical Observatory, Cambridge, Mass. Harvard Univ., Cambridge, Mass.). Science, 153: 981-4(Aug. 26, 1966).

Measurements of excess $^{36}$Ar + $^{38}$Ar (released mainly at 1200°C) in magnetic concentrates of Pacific sediments and in a dense concentrate of Greenland dust agree within an order of magnitude with expected concentrations implanted by solar-flare ion streams of energy less than 10 Mev per atomic-mass unit. The agreement implies that more than 10% of each concentrate may be extraterrestrial, depending on size distribution and flare spectra. Rare-gas measurements on fine-grained dust can provide data on: solar-flare "paleo-ion" fluxes, energy spectra, and isotopic abundances; identification, mineralogy, and chemistry of interplanetary dust; influx rates to earth and sedimentation rates of oceanic cores; and lunar-surface residence and mixing times. (auth)

**44105** ADVANCED EVOLUTION OF A HELIUM STAR OF INTERMEDIATE MASS. Giannone, P. (Osservatorio Astronomico, Rome). Z. Astrophys., 64: 229-37(1966).

By the Henyey method the evolution of a helium-star model with mass of 2.9 $M_\odot$ away from the helium-star main sequence was recalculated in the helium-burning phase in the convective core and then was followed through the subsequent stage of shell-burning and of gravitational contraction up to the ignition of carbon-burning near the center. Radiation pressure, electron degeneracy and neutrino energy loss were included in the calculations. As the beginning the evolutionary track is upward in the H-R diagram and then it points to the left as the helium content in the core decreases. When the convective core dies out, shell burning and gravitational contraction move the star to the right. The central chemical composition is predominantly oxygen, central densities are very high and the gas is partially degenerate. Even with a very large amount of energy loss for photoneutrinos the model attains the temperature of ignition for carbon-burning at the center. (auth)

**44106** POSSIBILITY OF AN OSCILLATORY NATURE OF GRAVITATIONAL COLLAPSE. Gertsenshtein, M. E. Zh. Eksp. Teor. Fiz., 51: 129-34(July 1966). (In Russian).

Some arguments are advanced which indicate that gravitational collapse is not an irreversible attraction of matter toward the center but in reality an oscillatory equilibrium. Newtonian motion at zero pressure which is a classical analog of collapse is of an oscillatory nature; the latter persists in the associated general theory of relativity coordinate systems. For a spherically symmetric conservative motion the transition from compression to expansion admits of two possibilities: either passage through the center with a nonzero velocity or a turning point at a finite distance from the center. It is shown that the first case holds in the relativistic case for all possible relativistically invariant state equations such that $p = \beta\epsilon$, $0 \leq \beta \leq 1$. Oscillatory collapse regarded as a supernova model is discussed. Such a model should be possible if oscillatory collapse can be observed from the outside, i.e., from the R-region. However this problem remains open. (auth)

**44107** SOME REMARKS ON THE SINGULARITIES OF THE COSMOLOGICAL SOLUTIONS OF THE GRAVITATIONAL EQUATIONS. Grishchuk, L. P. Zh. Eksp. Teor. Fiz., 51: 475-81(Aug. 1966). (In Russian).

It is shown that for space filled with dust matter the gravitation equation solution which depends on the maximal number (eight) of physically arbitrary functions of three variables possesses a true singularity. (auth)

## Atomic Physics

*Refer also to abstract 43660.*

**44108** (AD-630172) CALCULATIONS IN ATOMIC SCATTERING PROBLEMS AND ATOMIC STRUCTURE. Final Report, May 1, 1960-February 1, 1966. Borowitz, Sidney (New York Univ., N. Y. Dept. of Physics). Mar. 31, 1966. Contract Nonr-285(49). 10p. CFSTI $1.10 cy, $0.50 mn.

Results of studies in the following areas are briefly summarized: (1) derivation of the Thomas-Fermi atomic model from the main body of the Schrodinger equation; (2) low energy scattering of electrons and positrons by atoms; (3) high-energy scattering of electrons by atoms. A bibliography of the 46 papers resulting from the studies is included. (TAB)

**44109** (CALT-532-3) REACTION DYNAMICS IN CROSSED MOLECULAR BEAMS. Crawford, Oakley H. (Illinois Univ., Urbana). 1966. Contract AT(04-3)-532. 167p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Thesis.

An apparatus constructed to use crossed molecular beams to study reaction dynamics is described. Beams are produced and defected in this apparatus. However, scattering measurements were not made because of insufficiently high signal-to-noise rates. Features of design and construction of the apparatus are presented. Computer programs are used to analyze a realistic set of hypothetical experimental results. Two important conclusions are drawn. First, it is feasible to calculate precise expectation values of laboratory signals corresponding to assumed velocity-differential reaction cross sections. Spreads of reactant beams in direction, speed, and spatial extension, as well as the size and directionality of the detector entrance, are properly taken into account. With modifications, the technique should be applicable to other crossed-beams experiments also, such as those using velocity selection of a product, or no velocity selection at all. The second conclusion is that detailed information about reaction dynamics can be extracted from this type of experiment, while at the same time a good value of the total reaction cross section is very hard to obtain. The possibilities and limitations of a method of interpreting experimental data are illustrated in a set of realistic examples. Practical consequences in terms of design of experiments are given. (auth)

**44110** (IPP-1/50) EINE EMPIRISCHE FORMEL FUER DEN IONISIERUNGSQUERSCHNITT GEGENUEBER ELEKTRONENSTOSS. (An Empirical Formula for the Electron Impact Ionization Cross Section). Lotz, Wolfgang (Institut fuer Plasmaphysik, G.m.b.H., Garching (West Germany)). Aug. 1966. 27p. Dep. mn.

An empirical formula with three free parameters is given for the representation of cross sections for single ionization of atoms and ions from the ground state by electron impact. Almost all experimental results can be approximated by this formula within 10% over the hole energy range between threshold and 10 kev; all experimental results can be approximated within experimental error. The formula proposed is not suitable to reproduce the exact contour of fine structures in the ionization cross section curve. (auth)

**44111** (ORNL-TM-1571) TRANSITION RADIATION AND LOW-ENERGY BREMSSTRAHLUNG FROM SILVER AND ALUMINUM FOILS BOMBARDED BY GRAZING-INCIDENCE ELECTRONS. Cram, Leighton Scott; Arakawa E. T.; Jones, G. E.; Birkhoff, R. D. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 78p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Thesis. Submitted by Leighton Scott Cram to Vanderbilt Univ., Nashville, Tenn.

The visible and ultraviolet light emitted by silver and aluminum foils bombarded by high energy electrons was investigated experimentally. The absolute photon intensity was measured and its dependence upon angle of electron incidence, wavelength, electron energy, and foil thickness was determined. The spectral distribution of this radiation was studied specifically for grazing incidence electrons on these metals. Results were compared with theoretical calculations of bremsstrahlung and transition radiation. The optical emission spectra of silver and aluminum foils showed greatly enhanced emission upon bombardment by grazing incidence electrons as compared to normal incidence electrons. Spectra observed from thick silver films evaporated onto tantalum backings were inconclusive in that results could not be verified as due to plasma radiation, transition radiation, and/or bremsstrahlung. (W.D.M.)

**44112** (ORNL-tr-1266) COMMENT ON THE MULTIPLE EMISSION OF SECONDARY ELECTRONS. Kollath, R.; Simon, K.-H. Translated for Oak Ridge National Lab., Tenn., from Z. Phys., 179: 274-5(1964). 4p. Dep. mn. JCL $1.10 fs, $0.80 mf.

In secondary electron emission (SE), the yield refers to the mean number of secondary electrons (S) which are produced by a primary electron (P). The first direct experimental determination of the distribution function produced the surprising finding that the probability $P_n$ for groups with an even number of S is relatively greater than for groups with an odd number of S—a result which is entirely incompatible with the usual statistical interpretation of SE. For this reason, studies on this problem were carried out and the method used is outlined. Other applications for the method are mentioned. (M.H.R.)

**44113** ENTROPIES AND LAWS OF BOSON AND FERMION DISTRIBUTION CONSIDERING THE CLASSICAL MIXTURE ENTROPY CONCEPT. Ruiperez, L. Garzon (Catedra de Quimica Fisica, Oviedo, Spain). An. Real Soc. Espan. Fis. Quim., (Madrid), Ser. A, 62: 187-90(July-Aug. 1966). (In Spanish).

A gas of bosons or of fermions is considered as a mixture (in the classical thermodynamic sense) of two types of entities: bosons or fermions on the one side, and the opposite on the other. The expression of the variation of the mixture entropy is applied and expressions of entropies and distribution laws for the statistical quantities are deduced. (tr-auth)

**44114** SCATTERING OF ELECTRONS ON RESIDUAL GAS. Brauer, K. H.; Kittler, H. (Martin-Luther-Univ., Halle-Wittenberg, Ger.). Ann. Physik (7), 17: 113-18 (1966). (In German).

The Mott scattering formula for scattering on monoatomic gases was integrated over a scattering length, and the scattered intensity for helium was represented as a function of the distance of the primary focus. In a numerical evaluation for a given scattering length and wavelength, intensity values were recorded. The fraction of the intensity scattered elastically along a scattering length is negligibly small for large distances from the primary focus. It scarcely contributes to the background scattering. The principal fraction is to be expected in the immediate vicinity of the primary focus. The scattering function has a hyperbolic pattern. The supplementary fraction in the intensity profile of a diffraction reflection or of an electron microscopically formed point or of an edge, caused along a scattering path in the residual gas of electron optical installations, was indicated. (tr-auth)

**44115** ANGULAR DISTRIBUTION OF BACKSCATTERED ELECTRONS AND BACKSCATTERING COEFFICIENT. Okabe, Shigeru; Tabata, Tatsuo; Ito, Rinsuke. Ann. Rep. Radiat. Center Osaka Prefect., 6: 51-5(1965).

By using an x-ray compensation-type ionization chamber, the relative intensities of backscattered electrons were measured in the angular range 90 to 160° for monoenergetic electrons of energies 3.2 to 14.1 Mev normally incident on thick targets of Al, Cu, Ag, and Au. The electron beam was produced by a linear accelerator, and after being analyzed with a magnet, impinged on the target placed in the scattering chamber. The angular distribution of backscattered electrons was found not to show much variation with incident energy $E_0$ or target atomic number Z in this energy region. Backscattering coefficients were derived from observed results with the aid of a normalization constant obtained from a comparison with the data of Wright and Trump. Frank's prediction that the backscattering coefficient in the Mev region might be a function of only a single variable $Z/E_0$ was found to hold in the region approximately represented by $E_0 \geq 4.5 \times 10^2/Z^{1.3}$ Mev. It was also found that the backscattering coefficient p is given by a simple empirical relation $p = 1.0\ (Z/E_0)^{1.2}$ for $Z/E_0 \lesssim 8$ (p in % and $E_0$ in Mev). (auth)

**44116** ENERGY DISTRIBUTION OF BACKSCATTERED ELECTRONS. II. Tabata, Tatsuo; Okabe, Shigeru; Ito, Rinsuke. Ann. Rep. Radiat. Center Osaka Prefect., 6: 56-9(1965).

The energy spectrum of backscattered electrons was measured for monoenergetic electrons of energies 3.2 to 14.1 Mev impinging normally or obliquely on the thick Au target. The ratio of the most probable energy loss of backscattered electrons to the incident electron energy, observed at the scattering angle of 160° in the case of normal incidence, was found to increase from about 27 to 65% with increasing energy in this region. The ratio observed near the reflection angle in the case of 60° oblique incidence varied with energy only a little around 10%. The variation of energy spectrum with target atomic number was also studied by using Ag and Cu targets. (auth)

**44117** ANOMALOUS SECONDARY ELECTRON EMISSION. I. PURE METALS. Okabe, Shigeru; Tabata, Tatsuo; Tsumori, Kunihiko. Ann. Rep. Radiat. Center Osaka Prefect., 6: 60-3(1965).

Anomalous secondary electron emission from metal foils was studied with an improved test chamber. The foils were Pt, Au, Pd, Ag, Al, and Ti. An 18 Mev electron linear accelerator was used as a source of primary electrons. Typical anomalous emission comes about suddenly or gradually after few hours irradiation with increased emission coefficient 10–20 times the normal case and shows a spontaneous emission having a decay time of a few minutes after the beam is stopped. Usually anomalous emission increases with the rise of voltage difference between two foils. It may be a kind of field emission occurring temporarily from the dielectric insulating layer built up by beam radiation. (auth)

**44118** ENTRAPMENT IN TUNGSTEN OF HELIUM POSITIVE IONS OF KINETIC ENERGIES IN THE RANGE 60 ev TO 1 kev. Close, K. J.; Yarwood, J. (Polytechnic, London). Brit. J. Appl. Phys., 17: 1165-71(Sept. 1966).

Monoenergetic helium ions produced within a specially constructed 180° magnetic deflection mass spectrometer were directed at normal incidence on to the clean surface of a well-aged polycrystalline tungsten ribbon in an ultrahigh vacuum. The total ion flux used was not greater than $10^{13}$ ion/cm$^2$ at energies between 60 ev and 1 kev. The gas trapped in the metal was then desorbed into the known isolated volume of the mass spectrometer by heating the tungsten ribbon to 2200°C. The mass spectrometer, tuned to helium at mass number 4, measured the increase in partial pressure due to desorbed helium. From the measured quantity of helium desorbed, ion sticking probabilities were determined to be from 0.03 at 60 ev to 0.69 at 1 kev. (auth)

**44119** CAPILLARY ARC SOURCE FOR PRODUCTION OF $Hg^+$ IONS. Roth, Lothar. (Forschungsstelle fuer Technische Gasentladungen, Potsdam, Ger.). Exp. Tech. Phys., 13: 420-5(1965). (In German).

The construction of a simple low-voltage capillary arc ion source with pool cathode for the production of $Hg^+$ ions with concurrent separation of ion and neutral vapor beams is described. The capillary part of the source is made interchangeable so that the source properties can be varied in a wide range. The maximum ion current obtained is 1 mamp. The ion separation of neutral vapor beam is done by electrostatic deflection of 90° using a specially developed reflection cathode. (tr-auth)

**44120** ALTERNATE-GRADIENT FOCUSING OF MOLECULAR BEAMS. Auerbach, Daniel; Bromberg, Edward E. A.; Wharton, Lennard (Univ. of Chicago). J. Chem. Phys., 45: 2160-6(Sept. 15, 1966).

Space focusing of molecular beams is an established technique achieved by multipole fields for molecules in states that gain energy with applied field. Very often, however, one wants to focus molecules in states that lose energy with applied field. This latter problem is discussed here, and it is shown that the technique called strong or alternate-gradient (AG) focusing is of quite general applicability. The dipole, "two-wire" field is shown to be the neutral beam analog of the magnetic or electric quadrupole used for AG focusing of charged beams. Exploitation of circular motion or large energy change to achieve focusing is discussed, although these methods do not seem to be as widely applicable as AG focusing. Some specific field configurations and applications are considered: (1) focusing in a molecular-beam accelerator, (2) "flop-in" state selection for positive polarizability or effective moment, (3) beam storage, (4) novel spectroscopy for measuring dipole moments and polarizabilities to high accuracy, that has further applications for high-purity state selection, (5) velocity selection. (auth)

**44121** MOLECULAR-BEAM SCATTERING FROM THE (111) PLANE OF SILVER. Saltsburg, Howard; Smith, Joe N. Jr. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Contract AF 49(638)-1435. J. Chem. Phys., 45: 2175-83(Sept. 15, 1966).

The spatial distributions of molecular beams of $CH_4$, $NH_3$, He, Ne, Ar, and Xe scattered from the (111) plane of an epitaxially grown Ag single crystal were examined both during growth of the Ag crystal and immediately afterward, and no distinction between these modes was observable. The scattering of Ne, $CH_4$, and $NH_3$ was compared to illustrate the important role of the gas-metal interaction energy; $NH_3$, the most strongly interacting gas, gives rise to nearly diffuse scattering, while Ne is nearly specularly directed. Although the scattering of He is essentially specularly directed at all incident angles and temperatures, the heavier gases (Ar and Xe) exhibit scattering maxima lying between the specular direction and the tangent to the surface (supraspecular scattering), with the location of the maxima depending in a complex manner on the angle of incidence of the beam and the beam energy. Since a necessary condition for supraspecularity is that the beam temperature be greater than the surface temperature, an energy-transfer step seems to be involved in determining the particle trajectory. Similar complexities in the intensity of the scattered-beam maxima are observed; however, no simple explanation seems to suffice in this case. (auth)

**44122** EXPERIMENTAL AND THEORETICAL CONSIDERATIONS FOR IONIZATION OF SIMPLE HYDROCARBONS, $H_2$, $D_2$, $O_2$, $H_2O$, AND THE RARE GASES BY 2.2-Mev $\alpha$ PARTICLES AND BY ELECTRONS IN A MASS SPECTROMETER. Rudolph, P. S.; Melton, Charles E. (Oak Ridge National Lab., Tenn). Contract W-7405-eng-26. J. Chem. Phys., 45: 2227-32(Sept. 15, 1966). (ORNL-P-2140).

The measurement of ionization cross sections and mass spectra produced by 2.2-Mev $\alpha$ particles is briefly discussed with emphasis on experimental details that lead to results more accurate than those of the previous study. Experimental techniques and apparatus were developed and applied to these measurements for $H_2$, $D_2$, $O_2$, $H_2O$, $CH_4$, $C_2H_2$, $C_2H_4$, $C_2H_6$, and the rare gases. The experimental results for $H_2$ and He are compared with detailed calculations in the Börn–Bethe approximation and for Ar in the classical approximation. The ionization cross sections for the removal of one electron conform rather well to the predictions although the experimental results tend to be somewhat lower, than the theoretical values. Experimental values for He, Ar, $H_2$, and $N_2$ are in good agreement with extrapolated data of McDaniel and co-workers. The mass spectra produced by 2.2-Mev $\alpha$ particles show the same fragments as those produced by electrons with the same velocity, but the abundances of some fragment ions differ by a factor of four. Mass spectra produced by 75-ev electrons (the usual energy employed in conventional mass spectrometry) also show significantly more dissociative ionization than those produced by 2.2-Mev $\alpha$ particles. (auth)

**44123** FINITE NUCLEAR MASS EFFECTS ON THE CENTRIFUGAL STRETCHING CONSTANT IN $H^{35}Cl$. Herman, R. M.; Asgharian, A. (Pennsylvania State Univ., University Park). J. Chem. Phys., 45: 2433-8(Oct. 1, 1966).

It is suggested that the existing discrepancy between the experimentally determined $^{35}HCl$ energy-level constant $Y_{02}$ and its value, as predicted through Dunham's theory, represents a deviation from Born-Oppenheimer behavior. Relations between $^1\Sigma$-state molecular energy-level constants, corrected to take account of deviations from Born-Oppenheimer behavior, are then used in a recalculation of the Dunham theoretical value for $Y_{02}$. The discrepancy is not removed through the present calculation, however. The fractional difference between the Dunham values with and without corrections for deviations from Born-Oppenheimer behavior is $-0.29 \times 10^{-3}$, as opposed to the fractional difference $(0.649 \pm 0.065) \times 10^{-3}$ between the experimental and (uncorrected) Dunham theoretical values. The importance of the present calculation to an accurate spectroscopic determination of the velocity of light is indicated. (auth)

**44124** OPERATOR FOR SPIN-FORBIDDEN TRANSITIONS. Englman, Robert (Israel Atomic Energy Commission Labs., Yavne). J. Chem. Phys., 45: 2669-72 (Oct. 1, 1966).

It is shown that the use of the dipole-moment operator to calculate probabilities of transitions with change of spin gives results in many cases correct to within 1 to 1/100%. The matrix element of the operator is between the large components of spinors. (auth)

**44125** INTERPRETATION OF THE CROSS SECTION FOR VIBRATIONAL EXCITATION OF MOLECULES BY ELECTRONS. Chen, Joseph C. Y. (Joint Inst. for Lab. Astrophysics, Boulder, Colo.). J. Chem. Phys., 45: 2710-12(Oct. 1, 1966).

The cross section for resonance vibrational excitation of molecules such as $N_2$ by electrons first becomes appreciable at an energy which is an increasing function of the vibrational quantum number v of the upper state. This behavior appears as if the first maxima of the cross-section curves shift to higher energies as v increases, and seem not consistent with the excitation mechanism in which the vibrational excitation proceeds via compound negative-ion states as intermediates. It is shown that the shift is not a real shift of the positions of the resonance maxima as has been believed, but is due to the behavior of the nuclear matrix elements. (W.D.M.)

**44126** EFFECTS OF EXCITATION ENERGIES ON NUCLEAR SPIN COUPLING CONSTANTS. Saika, A. (Kyoto Univ.). J. Chem. Phys., 45: 2715-16(Oct. 1, 1966).

In calculating nuclear spin coupling constants by making a mean triplet excitation energy approximation in perturbation theory, it is usually assumed that variations of the excitation energies $\Delta E$ in a series of closely related molecules are negligible. There has been some doubt as to the validity of this presumption, and it has been questioned whether $\Delta E$ is the same for the $^{13}C-H$ coupling in methane and methyl halides. The question is examined by explicitly taking into account excited states. The simple wavefunctions employed for the valence electrons are constructed, and the Fermi contact contribution retaining only one-center integrals is evaluated. (W.D.M.)

**44127** CHARGE TRANSFER REACTIONS OF NITRIC OXIDE WITH ATOMIC AND MOLECULAR IONS OF OXYGEN AND NITROGEN. Turner, B. R.; Rutherford, J. A.; Stebbings, R. F. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Contract DA-49-146-XZ-354. J. Geophys. Res., 71: 4521-5(Oct. 1, 1966).

The cross sections for charge transfer in collisions between nitric oxide and atomic and molecular positive ions of oxygen and nitrogen were measured in the energy range from 3 to 200 ev in a crossed-beam experiment. A smooth interpolation is made between these results and the rate coefficients obtained at thermal energy by the afterglow technique. The dependence of these cross sections upon the energy of the electrons used to produce the primary ions was investigated to gain insight into the importance of the states of excitation of the primary ions. (auth)

**44128** SPECTRA OF $^{208}$Po AND THE HYPERFINE STRUCTURE OF $^{209}$Po. Charles, G. W. (Oak Ridge National Lab., Tenn.). J. Opt. Soc. Amer., 56: 1292-7 (Oct. 1966). (ORNL-P-2130).

Data are presented on the wavelengths of 97 lines of $^{208}$Po and on the hyperfine structure of 31 lines of $^{209}$Po. From these data, relative values of 26 energy levels of $^{208}$Po(I) have been deduced. The hyperfine-structure splittings of 14 of these levels in $^{209}$Po have been determined. Some tentative identifications of the levels have been made, based on a determination of the absolute value of the fundamental level $6p^4\ ^3P_2'$ by application of a Ritz formula to three levels taken as $6p^3(^4S)np\ ^5P_3'$, n = 7, 8, 9. The ionization potential of $^{208}$Po has been tentatively estimated as $8.41_4$ V. From the measured splittings of the energy levels of the configuration $6p^4$ of $^{209}$Po(I), the nuclear magnetic moment of $^{209}$Po is estimated to be $0.7_6$ nm. Mrozowski's identifications of some lines of Po(I) are examined. It is found that his identifications of the 4611 and 5940 Å lines are confirmed by coincidence of frequencies and by hyperfine-structure patterns, but that his identifications of the other lines and his determination of $6p^4\ ^1S_0'$ could not be confirmed by the data of this investigation. (auth)

**44129** SELF-REVERSAL IN THE SPECTRAL LINES OF URANIUM. Laun, Donald D. J. Res. Nat. Bur. Stand., 70A: 323-4(July-Aug. 1966).

In 1946, spectrum analysis indicated that the outer-electron configuration of normal uranium atoms was $5f^3\ 6d^1\ 7s^2$, with an energy level designated $^5L_6^0$ representing the normal state. Now that conclusion is experimentally verified by the observation of self-reversed lines in uranium spectra emitted by a high-current pulsed arc between metallic electrodes. Fifty-four reversed lines were observed; thirty-eight involve the normal state and sixteen are distributed among four low metastable states of the same configuration. (auth)

**44130** DISTRIBUTION FUNCTION OF DISTANCES BETWEEN ENERGY LEVELS OF AN ELECTRON IN A ONE-DIMENSIONAL RANDOM CHAIN. Pokrovskii, V. L. (Inst. of Theoretical Physics, Academy of Sciences, USSR). JETP Lett. (USSR) (Engl. Transl.), 4: 96-9(Aug. 15, 1966).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Redaktsiyu, 4: 140-4(Aug. 15, 1966).

The simplest one-dimensional model for which it is possible to obtain an explicit solution of the problem of the distribution of distances between electron energy levels is discussed. (M.O.W.)

**44131** SPUTTERING OF STAINLESS STEEL BY $H_1^+$ IONS AND PENETRATION OF THESE IONS INTO THE SURFACE. Borovik, E. S.; Katrich, N. P.; Nikolaev, G. T. pp 130-6 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The vaporization coefficient for stainless steel bombarded by $H_1^+$ ions as well as the penetration factor for these ions was investigated. A diagram of the measurement chamber is shown. Before bombardment, the target was degassed by heating to approximately 400°C for three hours. The target holder is insulated from the measurement chamber by a glass junction so that the ion current may be measured directly during bombardment of the target. The target was heated simultaneously with the measurement chamber by an external heater to approximately 300°C for three hours. Collector 6 (made from 0.05 mm aluminum foil) is a truncated cone with a diameter of 35 mm at the base and 24 mm at the apex. The collector is 70 mm long and is protected from the ion beam by screen 5 (made from stainless steel). (M.O.W.)

**44132** ESTIMATION OF THE CORRELATION ENERGY BETWEEN TWO PAIRED ELECTRONS. Santos, E.; de Santos, M. Leal (Univ., Costa Rica, San Jose). Nuovo Cimento (10), 45B: 87-91(Sept. 11, 1966).

A method is proposed to estimate the correlation energy between two paired electrons, that is, two electrons whose wave function is symmetrical with respect to the interchange of their spatial coordinates. The estimated correlation energy is then used to correct the energy values of several two-electron atoms that have been calculated previously without taking into account the correlation. A similar calculation is made for the hydrogen molecule. The agreement with experimental data is in the range of 0.2 ev. (M.O.W.)

**44133** ISOTOPE SHIFTS OF RESONANCE LINES IN THE SPECTRUM OF YTTERBIUM. Chaiko, Yu. (Inst. of Nuclear Studies, Rzhezh, Czech.). Opt. Spectros. (USSR)(Engl. Transl.), 20: 424-8(May 1966).

Translated from Opt. Spektros., 20: 760-7(May 1966).

Isotope shifts of the lines Yb(I) 3988, 5556 Å, and Yb 3694 Å were measured in the spectra of separated ytterbium isotopes, using a photoelectric spectrometer in conjunction with a Fabry-Perot interferometer equipped with a controlled scanning mechanism. The isotope shift constants $C_{exp}$ obtained from the experimental data are compared with calculations based upon the theory of the isotope effect in the spectra of elements with deformed nuclei, taking nuclear compressibility into account. The excellent agreement between the experimental and theoretical results permitted a determination of the internal quadrupole moment of the $^{168}$Yb nucleus: $Q_0(168) = 7.20 \times 10^{-24}$ cm$^2$. (auth)

**44134** DIFFRACTION CHANNELLING OF FAST ELECTRONS AND POSITRONS IN CRYSTALS. Howie, A. (Cambridge Univ., Eng.). Phil. Mag. (8), 14: 223-37 (Aug. 1966).

The theory of diffraction channelling is given in a form applicable to transmission experiments with fast electrons or positrons. In the case of the planar channelling of electrons the energy dependence of the channelling phenomenon leads to derivations from the simple v and $v^2$ (v = velocity) laws for the behavior of the extinction distance and the penetration distance. The extinction distance appears to increase more slowly than v. The penetration distance initially increases more slowly than $v^2$ but above a critical voltage $V_c$ it increases faster than $v^2$ so that in high voltage electron microscopes substantial additional increases in penetration may be possible. For the crystal orientations considered $V_c$ takes values of 200 kv, 700 kv and 1500 kv in Au, Cu and Al respectively. In the case of positrons good transmission occurs for directions parallel to a row or plane of atoms in the crystal. This is similar to the effects observed with protons and $\alpha$ particles. For electrons, however, the transmission in such directions is poor. It is suggested that the angular effects recently observed in experiments where electrons are emitted from crystals may be understood on the basis of a modified form of the theory and that these emission experiments could provide a convenient alternative method of studying the channelling of electrons and positrons at various energies. (auth)

**44135** THEORY OF INELASTIC NEUTRON SCATTERING OF METALLIC ELECTRONS IN ONE-ELECTRON APPROXIMATION. Dietze, H.-D. (Oak Ridge National Lab., Tenn.). Contract W-7405-eng-26. Phys. Kondens. Mater., 5: 178-91(1966). (ORNL-P-13).

The cross section is studied for the inelastic magnetic scattering of epithermal neutrons by electrons in a metal where the states for the electrons are described by band theory. If the ratio between the wave number of the electrons and the wave number of the incoming neutrons is small compared with unity but not smaller than the mass ratio between electron and neutron, it is possible to calculate the cross section in the vicinity of certain scattering angles more closely. By such experiments one could obtain some information about the diameter of the Fermi surface and the mass tensor of the electrons. (auth)

**44136** AVERAGE CHARGE OF STRIPPED HEAVY IONS. Betz, H.-D.; Hortig, G.; Leischner, E.; Schmelzer, Ch.; Stadler, B.; Weihrauch, J. (Univ., Heidelberg. Max Planck Instut fuer Kernphysik, Heidelberg). Phys. Lett., 22: 643-4(Sept. 15, 1966).

Charge distributions were measured for 10- to 70-Mev S, As, I, and U ions after passage through different gas and foil strippers. An empirical expression for the average equilibrium ionization as a function of particle velocity, nuclear charge and stripper properties is given. (auth)

**44137** ANISOTROPY OF THE DEBYE-WALLER FACTOR FOR THE MOESSBAUER EFFECT IN THIN FILMS. Corciovei, A.; Raedescu, E. (Inst. of Atomic Physics, Bucharest). Phys. Lett., 23: 32-3(Oct. 3, 1966).

An analytical expression is obtained for the Debye-Waller factor for thin films, predicting an anisotropy for emission or absorption of gamma quanta; the dependence of this factor on the number q of mono-atomic layers, force constants and temperature is studied. (auth)

**44138** ELECTRON CAPTURE INTO THE 2s-STATE OF HYDROGEN IN CLOSE $H^+$-He COLLISIONS. Dose, V.; Meyer, V. (Univ., Zurich). Phys. Lett., 23: 69-70 (Oct. 3, 1966).

The cross section for the reactions $H^+ + He \rightarrow H(2s)$, $D^+ + He \rightarrow D(2s)$ and $D^+ + H_2 \rightarrow D(2s)$ was measured at a scattering angle of 2.2° in the energy range from 4.5 to 60 kev. (auth)

**44139** ENERGIES OF NEUTRAL SPUTTERED PARTICLES. Oechsner, H.; Reichert, L. (Univ., Wuerzburg, Ger.). Phys. Lett., 23: 90-2(Oct. 3, 1966).

An experimental method for determining ejection energies of sputtered neutrals, based on high electron temperatures in a h-f discharge, is described. Preliminary results are reported. (auth)

**44140** CROSS SECTIONS FOR DOUBLE ELECTRON CAPTURE BY 2- TO 50-kev PROTONS INCIDENT UPON HYDROGEN AND THE INERT GASES. Williams, J. F. (Australian National Univ., Canberra). Phys. Rev., 150: 7-10(Oct. 7, 1966).

The cross section for capture of two electrons by protons in single collisions with hydrogen and inert gas targets has been measured over the energy range 2 to 50 kev. Cross-section values are given relative to the well-known single-electron-capture cross section by protons in each target gas. In hydrogen, a peak value of $1.0 \times 10^{-17}$ cm²/molecule at 17 kev is obtained for the double-capture cross section $\sigma_{1,-1}$. The double-peaked cross section versus velocity function, which is probably attributable to 10/-12 and 10/-13e processes, is confirmed. In He, the cross section $\sigma_{1,-1}$ reaches a maximum of $7.10^{-19}$ cm²/atom at 30 kev and steadily decreases to $2.10^{-20}$ cm²/atom at 2 kev. In Ne, the present values show a peak cross section of $1.2 \times 10^{-18}$ cm²/atom being reached at 14 kev. The present values when extrapolated above 50 kev agree well with Mittleman's corrected Born approximation calculations for $H_2$. (auth)

**44141** HYPERFINE STRUCTURE $^2D_{5/2}$ AND $^4F_{9/2}$ STATES OF $^{107}$Ag AND $^{109}$Ag. Blachman, Arthur G.; Landman, Donald A.; Lurio, Allen (Columbia Univ., New York). Phys. Rev., 150: 59-68(Oct. 7, 1966).

The hfs of the $(4d^95s^2)$ $^2D_{5/2}$ and $(4d^95s5p)$ $^4F_{9/2}$ metastable electronic states in $^{107}$Ag and $^{109}$Ag were measured by the atomic-beam magnetic-resonance method. The results, including the hfs dipole interaction constants which were corrected for second-order interactions with neighboring fine-structure levels, are given. The hfs anomaly for each of the two states is $^{107}\Delta^{109}(^2D_{5/2}) = 0.00012(1)$ and $^{107}\Delta^{109}(F_{9/2}) = -0.00298(3)$. By comparing the anomaly in the $^2D_{5/2}$ state with that in the ground $^2S_{1/2}$ state, the amount of s-state mixing into the $^2D_{5/2}$ state was obtained. The contribution to the hfs of the $^4F_{9/2}$ level from each of the individual valence electrons has been estimated. The observed anomaly in the $^4F_{9/2}$ state is in good agreement with the estimated s-electron contribution to the state. (auth)

**44142** LOCAL MAGNETIC FIELD SHIFT IN LIQUID AND SOLID XENON. Brinkmann, D.; Carr, H. Y. (Rutgers—The State Univ. of New Jersey, New Brunswick). Phys. Rev., 150: 174-9(Oct. 7, 1966).

Additional nuclear-magnetic-resonance measurements were made of the temperature and density dependence of the average local magnetic field at $^{129}$Xe nuclei in liquid and solid xenon samples in an external magnetic field $H_0$. The temperature range of the solid measurements was extended down to 21°K, and a computer of average transients was used to improve the signal-to-noise ratio and reduce the effects of random errors. The new liquid data covering the density range from 423 amagat to the triple point at 523 amagat show a linear dependence of the local field on density. The rate of increase of this local field with liquid density is $5.66 \times 10^{-7}$ $H_0$ G/amagat. The new data for the extended solid range from 577 amagat (triple point) to 639 amagat (21°K) show a nonlinear density dependence. The rate of increase of the local field with solid density $\rho$ is $5.10 \times 10^{-6}H_0 - 7.42 \times 10^{-9}\ \rho H_0$ G/amagat. The new data confirm the previously established discrepancy between the solid density dependence measured in this laboratory and the dependence measured by Yen, Norberg, and Warren. This discrepancy remains unexplained. (auth)

**44143** NUCLEAR MAGNETIC RESONANCE LOCAL-MAGNETIC-FIELD SHIFT IN SOLID XENON. Lurie, Joan; Feldman, Joseph L.; Horton, George K. (Rutgers—The State Univ. of New Jersey, New Brunswick). Phys. Rev., 150: 180-5(Oct. 7, 1966).

The shift in the value of the magnetic field at a xenon atom relative to the external field is calculated for solid xenon. The theory used here is a simple extension of the results obtained by Adrian for this local-magnetic-field shift in the gas. The quasiharmonic approximation and nearest-neighbor force models is used to compute the effect of lattice vibrations on the shift. The effect of thermal expansion on the shift is computed from the experimental data. It is shown that these results are insensitive to changes in the model used for the interatomic potential and relatively insensitive to changes in several parameters in the expression for $\Delta H$, the local-magnetic-field shift. There is a large and unexplained discrepancy between the experimental data for the shift in the solid obtained at Rutgers University and at Washington University. For a wide range of parameters, our results follow the Rutgers data quite closely. The usefulness of additional experimental data, taken on both xenon and the other magnetic rare-gas isotopes, is stressed. (auth)

**44144** ENERGY LOSS AND STRAGGLING OF ALPHA PARTICLES IN METAL FOILS. Comfort, J. R.; Decker, J. F.; Lynk, E. T.; Scully, M. O.; Quinton, A. R. (Yale Univ., New Haven). Contract AT(30-1)-3223. Phys. Rev., 150: 249-56(Oct. 7, 1966).

The energy loss and energy straggling of charged particles in foils of aluminum, nickel, silver, and gold have been studied as a function of total material thickness and of particle energy using 8.78 Mev Th C′ alpha particles and solid-state detectors. Energy thickness, stopping power, and straggling curves were obtained. The straggling results are compared with theoretical predictions of Bohr, Bethe, and Livingston, and of Titeica. Large discrepancies are found at low energy. Foil inhomogeneities and multiple scattering will probably not account fully for these. It is suggested that the effects of capture and loss of electrons, and the fluctuations of charge exchange are primarily responsible. (auth)

**44145** DEVICE FOR DEVELOPING FAST ATOMIC AND MOLECULAR BEAMS. Kamnev, A. B.; Leonas, V. B.; Popov, V. G. Prib. Tekh. Eksp., No. 2, 182-6 (Mar.-Apr. 1966). (In Russian).

A device for producing fast (energy $10^2 - 10^3$ ev) atomic and molecular beams is described. The device is used for determining intermolecular forces by studying elastic scattering of the beam in gases. (tr-auth)

**44146** THE EXCITATION OF ATOMS BY NEUTRAL PARTICLES. Vinogradov, A. V.; Poluektov, I. A. (Lebedev Inst. of Physics, Moscow). Teplofiz. Vysok. Temp., 4: 3-11(1966). (In Russian).

Cross-section calculations were made for inelastic collisions between heavy particles. A method is proposed for the construction of an approximate matrix element of transition, which retains the fundamental analytical properties of the precise method. A calculation is performed for the effective cross sections of excitation of hydrogen atoms during their collision with nitrogen molecules and hydrogen atoms. The results are in good agreement with experimental data. (M.O.W.)

**44147** ESTIMATION OF THE INCOHERENT COMPONENT IN THE MEASUREMENT OF COHERENT SCATTERING OF GAMMA RAYS AT SMALL ANGLES. Nath, A. (Bose Inst., Calcutta). Trans. Bose Res. Inst. (Calcutta), 27: 33-42(June 1964).

The correction of the cross section of coherent gamma scattering at small angles for the small energy shift of the associated Compton component was investigated. Numerical estimates were obtained from general theoretical considerations, and the modification of the scattered spectrum due to the Compton energy shift was studied using a $^{137}$Cs gamma source at different angles. A method for estimating the Compton intensity in the coherent peak was formulated. (D.C.W.)

**44148** INTENSITY DISTRIBUTION IN INDUCED COMBINATIONAL SCATTERING SPECTRA. Zubova, N. V.; Kuzmina, N. P.; Zubov, V. A.; Sushchinskii, M. M.; Shuvalov, I. K. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz., 51: 101-7(July 1966). (In Russian).

The line intensity of stimulated Raman scattering spectra (SRS) is investigated as a function of the exciting light intensity. The measurements are carried out in a region of intensities above and below of the experimental threshold for a single flash. The intensity distribution in SRS spectra is investigated for several Stokes and anti-Stokes components. The existence of a considerable wing accompanying each component is detected. A structure of the first Stokes component of SRS is found and is investigated in the region of threshold and below the threshold. (auth)

**44149** NUCLEAR $\gamma$ RESONANCE ON HIGHLY DISPERSIVE TIN. Suzdalev, I. P.; Gen, M. Ya.; Goldanskii, V. I.; Makarov, E. F. (Inst. of Chemical Physics, Academy of Sciences, USSR). Zh. Eksp. Teor. Fiz., 51: 118-20(July 1966). (In Russian).

The Mössbauer effect is investigated on highly dispersive tin with particle diameters of 250, 370, 600 and 1150 Å. It is shown that the probability of the effect decreases with decrease of the particle diameter and is related to the influence of the surface. The Debye temperature for the particle $\Theta$ is determined (it is respectively 120, 130, 135 and 140°K) and also for tin atoms in the surface layer, the thickness of which is five lattice constants ($\Theta$ = 100°K). (auth)

**44150** A COMMENT ON THE MULTIDIMENSIONAL COULOMB PROBLEM. Kuznetsov, G. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz., 51: 216-21(July 1966). (In Russian).

The Fock problem is extended to the multidimensional case. Explicit expressions are obtained (with all normalizing factors) for wave functions of the discrete as well as continuous spectrum of a f-dimensional "hydrogen atom". An "addition theorem" for functions of the continuous spectrum is derived. The functions are a convenient representation basis for the rotation group O(f + 1) and Lorentz group L(f + 1). A method for obtaining a different type of solution is indicated. As an example it is shown that for the hydrogen atom (f = 3) there exists a solution in Fock space which is identical with the symmetrical top function. (auth)

**44151** IONIZATION OF ATOMS IN A VARYING ELECTRIC FIELD. [PART] II. Perelomov, A. M.; Popov, V. S.; Terentiev, M. V. (Inst. of Theoretical and Experimental Physics, Moscow). Zh. Eksp. Teor. Fiz., 51: 309-26(July 1966). (In Russian).

Ionization produced in a system bound by short range forces induced by an electro-magnetic wave with arbitrary elliptic polarization is investigated. Formulas are obtained for the case of a weak field $F \ll F_0$, $\omega \ll \omega_0$ ($F_0$ is the intra-atomic field, $\omega_0$ is a characteristic atomic frequency) and multi-photon ionization. The formulas yield the ionization probability as the sum of multi-photon process probabilities. The momentum spectrum of the emitted electrons is defined. Transition to the adiabatic approximation for the case of low frequencies ($\gamma \ll 1$) is considered. Asymptotic formulas are obtained for the total ionization probability in the "anti-adiabatic" case ($\gamma \gg 1$). It is shown that with increase of ellipticity $\epsilon$ of the incident light the ionization probability decreases, other conditions being equal. A simple quasiclassical method for obtaining the main (exponential) factor in the formula for the ionization probability is presented. Some properties of the solutions of the Shroedinger equation for potentials with a Coulomb "tail" are discussed. (auth)

## Cosmic Radiation

***See also* Elementary Particles and Radiations**

**Nuclear Properties and Reactions**

*Refer also to abstracts 42726, 44084, and 44418–44425.*

**44152** GENERATION OF THE HIGH-ENERGY NUCLEON-ELECTRON CASCADE BY MEANS OF THE PROGRAM WRITTEN FOR THE SMALL COMPUTER. Massalski, J. (Inst. of Nuclear Research, Krakow); Pstrokonski, M.; Suszycki, L.; Warczewski, J. Acta Phys. Pol., 30: 149-58(July 1966).

Using the Monte Carlo method, a program for the generation of the nucleon-electron cascade along whole depth of the absorbent in the apparatus installed on the Mount Aragac was written. This work was undertaken with the aim to find the proper set of the parameters describing the nuclear interaction (for example inelasticity coefficients for C and Pb) by comparing the ionization in the trays of ionization chambers calculated by means of the program with the actually observed one in the apparatus. The above mentioned program can be run on a small computer such as UMC 1. (auth)

**44153** PROGRAM FOR THE INTERPOLATION OF THE CASCADE CURVES WITH THE AID OF A SMALL ELECTRONIC COMPUTER. Massalski, J. (Inst. of Nuclear Research, Krakow); Pstrokonski, M.; Suszycki, L.; Warczewski, J. Acta Phys. Pol., 30: 159-63(July 1966).

In the generation of the nuclear-electron process with the help of the program for the computer UMC 1 it was necessary to estimate simultaneously the number of the electrons for the four values of the absorbent thickness and for the optional value of the photon energy, which initiates a given cascade. The requirements of the short time and good accuracy of the computation were achieved when one uses the table of the cascade curves and the total number of electrons is estimated by the interpolation method. The total number of electrons as a function of two variables (the photon energy and the depth of the absorbent) can be represented by the Taylor's expansion and the acceptance of the first two terms only appears to ensure good accuracy. (auth)

**44154** 27-DAY VARIATION OF THE DIURNAL PATTERN OF THE INTENSITY OF COSMIC RADIATION. Zwanzig, W.; Fieber, W.; Flohr, B. (Univ., Halle, Ger.). Ann. Physik (7), 17: 127-31(1966). (In German).

The existence of a 27.3-day variation of the amplitude of

VARYING ELEC-
. M.; Popov,
tical and Experi-
or. Fiz., 51:

by short range
ve with arbitrary
nulas are ob-
, $\omega \ll \omega_0$ ($F_0$ is
stic atomic fre-
formulas yield
ulti-photon pro-
um of the emitted
abatic approxi-
$\ll 1$) is con-
d for the total
c" case ($\gamma \gg 1$),
$\epsilon$ of the inci-
ses, other con-
al method for
he formula for
me properties
n for potentials
h)

adiations
actions

4418—44425.

ERGY NU-
OF THE PRO-
TER. Mas-
ow); Pstro-
cta Phys.

for the gener-
hole depth of
he Mount
ken with the
describing
city coeffi-
tion in the
eans of the
e apparatus.
a small com-

TION OF
A SMALL
(Inst. of Nu-
uszycki, L.;
(July 1966).
ocess with
1 it was
ber of the
thickness
, which
f the short
re achieved
and the total
olation
nction of
of the ab-
pansion and
ears to en-

NAL PAT-
TION.
alle, Ger.).
n).
amplitude of

---

the diurnal pattern of the meson component of cosmic radiation over a 20-yr period is shown. A first maximum of the diurnal pattern coincides temporally with the maximum of the mean 27.3-day variation of the solar activity and the geomagnetic activity over the same time space; a second less-sharp maximum of the diurnal pattern coincides with the minimum. (tr-auth)

**44155** UPPER LIMIT OF THE SPECTRUM OF COSMIC RAYS. **Zatsepin, G. T.; Kuz'min, V. A. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.), 4: 78-80 (Aug. 1, 1966).**

**Translated from Zh. Eksperim. Teor. Fiz., Pis'ma Redakt., 4: 114-17 (Aug. 1, 1966).**

A brief discussion is presented on the value of knowing the energy spectra of primary cosmic radiations. (M.O.W.)

**44156** SUBCOSMIC ELECTRONS. **Rozental', I. L. Kosm. Issled., 4: 404-7 (May-June 1966). (In Russian).**

Investigation of primary cosmic radiation has been initiated, using artificial satellites and cosmic rockets, resulting in the discovery of cosmic and galactic x rays. A natural mechanism consisting of the appearance of a large number of electrons with energies from 0.01 to 10 Mev is assumed in the form of $\delta$-electron formation by fast cosmic-ray protons. Formulas are developed for the probability of $\delta$-electron formation by photons and for the differential spectrum of primary protons. The probability of $\delta$-electron formation is great compared with the formation of electrons at $\pi \rightarrow \mu \rightarrow e$ decomposition. The probability of bremsstrahlung of a photon with the energy w emitted by an electron is assumed to be $(8 \cdot 10^{-3}/w)$. The flux of bremsstrahlung photons caused by the $\delta$ process of nucleons with energies >500 Mev is equal to $10^{-3}$ quanta/cm$^2$ · sec · sterad. Although this flux is very small compared with that observed, it is nearer to the real flux than the fluxes obtained by other mechanical models. The total energy of cosmic radiation, as well as of radiative sources and the galaxy is greater than that found by the authors. Under such conditions, it is difficult to consider supernovae as the basic source of cosmic rays. The $\delta$ process plays some role in the formation of slow electrons in the radiation belts. (ATD)

**44157** CERTAIN REGULARITIES IN FORMATION OF HETEROGENITIES IN THE IONOSPHERE AND THEIR RELATION TO THE PARTICLE FALLOUT FROM COSMIC SPACE. **Bol'shoi, A. A. Kosm. Issled., 4: 568-73 (July-Aug. 1966). (In Russian).**

Systematized and developed data on the radio signals received from the Soviet satellites are discussed. The data confirmed that the observed "flickering" interruptions in radio signals emitted from cosmic objects are the result of radio wave diffraction in ionospheric heterogeneities. The frequency of radio flickering depends on the latitude of the cosmic object location and on the time of day. A relation was found between the radio flickering phenomenon and diffused scattered reflections from the F layer of the ionosphere. The relationship was established between the particle fallout from the ionosphere and flickering of radio signals from the satellite. It was concluded that the origin of the ionospheric heterogeneities is due, at least partially, to the particle fallout from cosmic space. (tr-auth)

**44158** OBSERVATIONS OF THE LOW-ENERGY PHOTON FLUXES DURING THE SOLAR APPROACH OF THE IKEYA-SEKI COMET. **Gronstal, Philip T.; Bukata, Robert P. (Southwest Center for Advanced Studies, Dallas). Nature, 211: 176-7 (July 9, 1966).**

A balloon-borne omnidirectional scintillation detector was used at Palestine, Texas to observe any possible enhancement to the low-energy atmospheric photon flux induced by the passage of the Ikeya-Seki comet. The detector consisted of a cylindrical NaI(Tl) scintillator of diameter 5 in. and depth ½ in., yielding a geometric factor for an isotropic flux of 76.2 cm$^2$. Pulse-height analysis techniques enabled a study of the atmospheric photon component in the energy intervals 100 to 325 kev, 100 to 660 kev, above 660 kev, and 325 to 660 kev. It is concluded that the solar approach of the comet produced no significant effects on the atmospheric photon flux. (W.D.M.)

**44159** EVIDENCE FOR A TWO-WAY SIDEREAL ANISOTROPY IN THE CHARGED PRIMARY COSMIC RADIATION. **Jacklyn, R. M. (Antarctic Div., Dept. of External Affairs, Melbourne. Univ. of Tasmania, Hobart). Nature, 211: 690-3 (Aug. 13, 1966).**

The first results are presented of an experiment designed to make it possible to decide whether the observed sidereal daily variation is, in the main, genuine or spurious. These results confirm the earlier indications that there is a genuine two-way sidereal anisotropy among the charged cosmic-ray primaries. (M.H.R.)

**44160** A CALCULATION OF THE NUMBER OF MUONS AT SEA-LEVEL IN A PHOTON-ELECTRON CASCADE INITIATED BY A PRIMARY PHOTON OF ENERGY $10^{14}$ ev. **Mishra, N. (Lady Brabourne Coll., Calcutta). Nuovo Cimento (10), 45B: 1-7 (Sept. 11, 1966).**

The muon component in a photon-electron cascade initiated by a photon of $10^{14}$ ev was estimated for sea level in the longitudinal development of the electromagnetic cascade. Two distinct possible processes of muon production were treated separately: (1) direct muon pair production, (2) decay of the photoproduced pions. On the average it is found that the number of muons at sea level with energy over 1 Bev may be less than one. Thus the ratio of the average number of muons at sea level with energy above 1 Bev to the total number of particles at sea level in such a shower is of the order of $10^{-3}$. (auth)

**44161** DAILY VARIATION OF COSMIC-RAY INTENSITY DURING ACTIVE AND QUIET PERIODS OF SOLAR ACTIVITY. PROFILE AND FINE STRUCTURE. **Kane, R. P. (Physical Research Lab., Ahmedabad, India). Nuovo Cimento (10), 45B: 8-31 (Sept. 11, 1966).**

Characteristics of daily variation are studied by examining several parameters viz amplitudes and phases of the various harmonics, individual hourly deviations from the daily mean, positions of hours of maxima and minima as also the actual profile on individual days. Averaged data from several neutron monitors of high counting rate reveal that the daily variation consists mostly of linear gradients (up or down) culminating into sharp (lasting for an hour or two) or broad (lasting for several hours) maxima or minima. Usually, one maximum and one minimum is obtained per day and their magnitudes and positions are partly interrelated, partly independent. The average directions are 18 and 6 hr in outer space but variations of ±2 hr (occasionally much larger) are observed from day to day. The daily range also varies from 0 to about 1.0%. Groups of days are observed on which the range is very small (about 0.2%); also others on which the minima lie on a steady level and maxima on a changing level or vice versa or both levels changing. Several other characteristics are discussed. Phase characteristics are found to be sharper in Quiet-Sun period 1964 as compared to I.G.Y. (auth)

**44162** AN EXPLANATION OF SOME INCONSISTENCIES OF DATA ON COSMIC RAYS WITH ENERGIES ABOVE $10^{11}$ ev BASED ON THE ASSUMPTON OF THE EXISTENCE OF A PASSIVE NUCLEON STATE. **Smorodin, Yu. A. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz., 51: 431-44 (Aug. 1966). (In Russian).**

It is shown that a number of inconsistencies in the experimental data on interactions between cosmic ray nucleons with energies $\gtrsim 10^{11}$ ev can be removed if it is assumed that after interaction the nucleon goes over to a passive state in which the nuclear interaction cross section is smaller than the normal cross section. Analysis of the experimental data pertaining to a broad energy range from $10^{11}$ to $10^{16}$ ev yields a single lifetime for baryons in the passive state. The value obtained is $\sim 10^{-10}$ sec which is the time characteristic for processes connected with change of parity in weak interactions. Estimations of the transition probability and cross section for baryon interaction in the passive state are discussed. (auth)

# Direct Energy Conversion

*Refer also to abstracts 45184 and 45195.*

**44163** (AD-628528) DIRECT ENERGY CONVERSION SYSTEMS. PART I. ELECTRICAL CONDUCTIVITY OF PARTIALLY IONIZED GASES. Quarterly Technical Report, March 1–May 31, 1965. Schweitzer, S.; Mitchner, M. (Stanford Univ., Calif. Dept. of Mechanical Engineering). Sept. 30, 1965. Contract AF49(638)-1123. 58p. (AFOSR-66-0225). CFSTI $3.00 cy, $0.50 mn.

A simplification of the Chapman-Enskog method for the calculation of the electrical conductivity of a multicomponent partially ionized gas in a magnetic field is presented. The calculation requires the inversion of a matrix which is of the order of the approximation, and is independent of the number of species. The third approximation to the electrical conductivity is examined for an electron-ion-neutral plasma and the results are compared with those obtained from the mixture rules of Lin, Resler, and Kantrowitz, and of Frost. It is shown that within the uncertainties in the experimental electron-neutral cross-section values, Frost's formula offers a satisfactory method of calculation for most engineering applications. (auth)

**44164** (IPP-3/39) ANALYTISCHE UNTERSUCHUNG DES INNENWIDERSTANDES VON MHD-GENERATOREN. (On the Internal Resistance of MHD Generators). Lengyel, L. L. (Institut fuer Plasmaphysik, G.m.b.H., Garching (West Germany)). June 1966. 32p. Dep. mn.

The internal resistance of MHD generators as a function of the electrode geometry and the Hall parameter is considered herein. The perturbation of the current and potential distributions by the Hall parameter and the effect of a staggered-electrode geometry upon the internal resistance are studied in detail. It has been found that changes in the internal resistance for equal positive and negative staggering angles are identical. (auth)

**44165** (IPP-3/41) EXPERIMENTELLE UNTERSUCHUNGEN DER STROMDICHTEVERTEILUNG IN EINEM MAGNETOHYDRODYNAMISCHEN GENERATOR MIT SEGMENTIERTEN ELEKTRODEN. (Experimental Investigations of the Current Density Distribution in a Magnetohydrodynamic Generator with Segmented Electrodes). Fischer, Fred W. (Institut fuer Plasmaphysik, G.m.b.H., Garching (West Germany)). July 1966. 51p. Dep. mn.

In a magnetohydrodynamic generator with segmented electrodes the current distribution is inhomogeneous due to the existence of the Hall effect. This is particularly true in the immediate vicinity of the electrodes. Calculations of the current density distributions in a generator whose working fluid is a rare gas–alkali metal plasma were based on a theory with many simplifying assumptions. The results of these calculations were compared with measurements on an argon–potassium generator. The temperature of the working gas was approximately 2000°K, and the flow velocity was 130 m/sec max. at a pressure of 1.1 atm. For the purpose of seeding, 0.22% (by weight) potassium was added to the argon. The magnetic field was 4.5 kG max. Conclusions could be drawn on the distribution of electron temperature, and thus on current density, from the spatial intensity distribution of the potassium resonance lines. In general, qualitative agreement was found with the theoretically determined distribution. Near the electrodes, especially along the insulating wall between two electrodes, considerable differences from theoretical values were noticed. Measurements of the electrical potential along the insulating wall confirmed these latter observations. (auth)

**44166** MAGNETOHYDRODYNAMIC GENERATORS: PRESENT POSSIBILITIES. ACEC (Ateliers Constr. Elec. Charleroi) Rev., No. 4, 15-32(1965).

The possibilities offered by the magnetohydrodynamic generator (MHD) in the developing field of electric power supply are discussed. After reviewing the principal physical bases which determine the operation of MHD generators, information is presented on the influence of the principal parameters, such as the electric conductivity of a plasma, its velocity, the intensity of the magnetic field and the main dimensions of such generators, on their maximum performance. Reviews are given of the various types of open- and closed-circuit and a-c types of generators, and the chief technical difficulties met with in their practical construction are pointed out and a survey of future prospects is included. (auth)

**44167** THE SHOCK TUBE AND PLASMA DYNAMICS. Kantrowitz, Arthur (Avco-Everett Research Lab., Everett, Mass.). J. Environ. Sci., 9: 13-17(June 1966).

The use of the shock tube for studying plasma dynamics and the development of magnetohydrodynamic (MHD) generators are discussed. Typical operating conditions for pressure-driven, combustion-driven, and arc-driven shock tubes are shown. By using shock tubes, it was possible to determine the re-entry environment of space vehicles with sufficient precision so that successful re-entry vehicles could be developed. Chemical kinetics, radiative emission from hot gases, and ionization studies were conducted directly with shock tube experiments. Heat transfer tests were carried out both in shock tubes and in arc-jet wind tunnels. The development of electric arc plasma generators made it possible to conduct wind tunnel tests of re-entry vehicle models under conditions closely simulating those of flight. Shock tube experiments provided knowledge of the stagnation heat transfer rate under given re-entry conditions. From this data, the arc jet could be adjusted to provide the necessary stagnation heat transfer. By applying knowledge of plasma conductivities, high-temperature materials, and aerodynamics, all gained in part through re-entry studies, it has become possible to develop practical combustion-fired MHD generators. To date, practical MHD generators have been restricted to combustion heat sources utilizing fossil fuels, since only such heat sources can provide high enough temperatures to thermally ionize the working plasma. One such generator is described. The design and use of the magnetic annular shock tube (MAST) and the Magnetic Annular Arc Accelerator (MAARC) are also described. (BBB)

**44168** ENERGETICS 4: THERMIONIC POWER. Houston, John M. (General Electric Research and Development Center, Schenectady, N. Y.). Mech. Eng., 88: No. 9, 56-9(Sept. 1966).

Generation of electric power by emission of electrons from a heated electrode in a thermionic converter is described. Designs for Cs filled converters, including one with a Re emitter and Ni collector are presented. Surface ionization and ignited mode operations are compared. (F.S.)

**44169** NEW METHODS OF DIRECT ENERGY CONVERSION. Euler, Karl Joachim (Varta AG, Frankfurt am Main). Naturwissenschaften, 53: 341-8(1966). (In German).

Newly developed and experimental methods for direct energy conversion are described. These include radioisotope batteries, galvanic fuel cells, thermoelements, thermionic converters, and magnetohydrodynamic generators. (J.S.R.)

**44170** THERMIONIC ENERGY CONVERTER. Hernqvist, Karl G. (to Radio Corp. of America). U. S. Patent 3,267,308. Aug. 16, 1966. Filed July 9, 1963.

A thermionic energy converter for operation in the ball-of-fire mode (high-pressure, low-temperature mode also known as the "arc mode") is discussed. The converter may be provided with auxiliary electrodes for initiating, improving, or controlling the ball-of-fire operation of the tube. Drawings, which show component changes and the complete tube structure, are shown. (J.H.M.)

**44171** MAGNETOHYDRODYNAMIC GENERATING DUCT. Way, Stewart (to Westinghouse Electric Corp.). U. S. Patent 3,271,597. Sept. 6, 1966. Filed Aug. 22, 1963.

An elongated duct for an MHD generating system is described. Design characteristics and advantages of the duct are discussed, and longitudinal and cross sections are shown. (J.H.M.)

**44172** IMPROVEMENTS IN OR RELATING TO MAGNETOHYDRODYNAMIC APPARATUS. Wright, John Keith; Swift-Hook, Donald Thomas; Green, Leonard Andrew (to Central Electricity Generating Board). British Patent 1,041,470. Sept. 7, 1966. Filed Mar. 20, 1964.

The construction of the wall of a duct for an MHD generating system is described. Design characteristics and advantages of the design are discussed, and sections of the wall are shown. (J.H.M.)

**44173** JOURNEES INTERNATIONALES DE LA COMBUSTION ET DE LA CONVERSION DE L'ENERGIE, ORGANISEES AVEC LE CONCOURS DE LA SOCIETE FRANCAISE DES THERMICIENS, 20 AU 23 MAI 1964, PARIS. (International Conference of Combustion and Energy Conversion, Organized with the Cooperation of the French Society of Thermal Engineers, May 20–23, 1964, Paris). Paris, Institut Francais des Combustibles et de l'Energie, 1964. 805p. (CONF-640515).

The 44 articles presented at this conference are compiled together with the discussion following each paper. The areas discussed at the conference were basic research on combustion, combustion of gaseous fuels, combustion of liquid fuels, combustion of solid fuels, and energy conversion. Individual abstracts were prepared for four of the papers. (J.S.R.)

*For abstracts of individual papers see: 44174, 44175, 44925, and 44926.*

**44174** PROPERTIES OF COLLISION AND COMBUSTION WAVES AND POSSIBILITIES OF THEIR APPLICATION TO ENERGY CONVERSION. Bellet, J. C.; Brossard, J.; Manson, N.; Veyssiere, M. (ENSMA, Poitiers, France). pp 95-106 of Journees Internationales de la Combustion et de la Conversion de l'Energie. Paris, Institut Francais des Combustibles et de l'Energie, 1964. (In French).

After a review of the principal properties of detonations propagated in a combustible gaseous medium, their remarkable total stability which permits the precise determination of some of their characteristic magnitudes is emphasized. The study of the fine structure of the detonation wave contributes largely to showing the details of complex phenomena such as energy transfers contributing to the coupling between the collision wave and the combustion wave and to the evolution of thermal electric magnitudes in the wave. The characteristics of this structure on the one hand and the high intensity of combustion due to the nature of the phenomenon on the other caused the detonation structure to constitute an interesting solution, not only for certain problems posed in the study of new propulsive sources, but also for those considered in gaseous magnetodynamics for the production of electricity. (tr-auth)

**44175** DIFFICULTIES AND HOPES CREATED BY MHD FOR THE LARGE CELL CONVERSION OF THERMAL ENERGY INTO ELECTRICAL ENERGY. Pericart, Jean. pp 657-84 of Journees Internationales de la Combustion et de la Conversion de l'Energie. Paris, Institut Francais des Combustibles et de l'Energie, 1964. (In French).

The problems of physics and aerodynamics posed by the startup of very hot high-velocity ionized gases are examined. The conversion of thermal energy into electrical energy is then reviewed, and general engineering questions with respect to an MHD installation are discussed. The state of development of research projects and the most important developments are summarized. (J.S.R.)

## Elementary Particles and Radiations

**See also Field Theory, Scattering Theory, and Symmetries**

*Refer also to abstracts 43738, 44089, and 44760.*

**44176** (LNF-66/31) A MEASUREMENT OF THE BRANCHING RATIO $\omega \rightarrow$ NEUTRALS/$\omega \rightarrow \pi^+ + \pi^- + \pi^0$. Note No. 325. DiGiugno, G.; Giorgi, M.; Peruzzi, I.; Schiavon, P.; Silvestrini, V.; Troise, G.; Vanoli, F. (Laboratori Nazionali di Frascati, Comitato Nazionale per l'Energia Nucleare (Italy)). June 21, 1966. 5p. Dep. mn.

The branching ratio $\omega \rightarrow$ neutrals $\omega \rightarrow \pi^+ + \pi^- + \pi^0$ was measured at CERN using a counter technique. The value obtained was 13.4 ± 2.6% in comparison with the world average of 10.6 ± 1%. Details are given on the experimental technique and method. (J.S.R.)

**44177** (NP-16278) OB IZUCHENII $\pi^-$-p VZAIMODEISTVII V PUZYR'KOVOI KAMERE S TYAZHELOI ZHIDKOST'YU. (Remarks on Investigation $\pi^-$-p Interactions in Heavy Liquid Bubble Chambers). Report No. 423. Elenskii, Ya. S.; Shebanov, V. A. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Teoreticheskoi i Eksperimental'noi Fiziki). 1966. 16p. Dep. mn.

The percentages of interactions on free protons ($n_1$) and on bound protons without nuclear breakup ($n_2$) of H-like events ($n_1 + n_2$) were measured in a propane-xenon bubble chamber at 2.8 Bev/c. In addition to 3000 pictures in propane-xenon bubble chamber about 3000 photos in freon and 3000 photos in xenon bubble chambers were analyzed. The difference method was used to determine the ratio $\alpha_{B.c.} = n_2/n_1 + n_2$. The result is $0.37 \leq \alpha_{B.c.} \leq 0.62$ for the various H-like reactions, when kinematical selection criteria were not used. Besides that from the data, obtained in the bubble chamber the value $\alpha_{s.c.}$ was evaluated for possible spark chamber experiments when spark chamber electrodes contain free hydrogen. $\alpha_{s.c.}$ is close to $\alpha_{B.c.}$ if the electrode thickness is less 0.2 g/cm$^2$. (auth)

**44178** (UCRL-16881) MULTI-PION FINAL STATES FROM $\pi^-$p INTERACTIONS AT 3.2 AND 4.2 Bev/c. Chung, Suh Urk (Lawrence Radiation Lab., Univ. of California, Berkeley). July 8, 1966. Contract W-7405-eng-48. 240p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

Thesis.

An analysis was made of approximately 30,000 four-prong events at $\pi^-$ beam momenta of 3.2 and 4.2 Bev/c, obtained with the 72-inch hydrogen bubble chamber at the Lawrence Radiation Laboratory. All the effective-mass distributions obtainable from the final states $p\pi^+\pi^-\pi^-$, $p\pi^+\pi^0\pi^-\pi^-$, and $n\pi^+\pi^+\pi^-\pi^-$, as well as the cross sections of these final states are presented. In addition, the results of a study of the quasi-three-body final states $N^{*++}$ (1238)$\pi^-\pi^-$, $p\pi^-\rho^0$. $p\pi^-\omega$, and $p\pi^-\eta$ are presented. Particular emphasis was given to the production and decay of the $A_1$, $A_2$, and B enhancements; the $A_1$ and B enhancements observed in the data are consistent with the interpretations as kinematic enhancements, and the $A_2$ enhancement can be interpreted only as a genuine resonant state. From the study of the decay angular correlations in the $A_2$ region as well as the control regions, it was determined that the lowest possible quantum numbers of the $A_2$ are $J^P = 2^+$. (auth)

**44179** RADIATION CORRECTIONS FOR e-p SCATTERING. Bartl, A. (Univ., Graz). Acta Phys. Austr., 22: 32-40(1966). (In German).

Formulas for the radiation correction in e-p scattering are formulated considering only the total contribution of the soft photons. The equations are numerically evaluated and the results are tabulated. (J.S.R.)

**44180** A MODEL FOR DESCRIBING PARTICLE PRODUCTION BY INELASTIC ELECTRON-NUCLEON SCATTERING AND THE EXACT ANALYTICAL CALCULATION OF PHASE SPACE INTEGRALS. Loder, R. K. (Univ., Graz). Acta Phys. Austr., 22: 221-44(1966). (In German).

The Fermi statistical theory is used in the formulation of a model for the description of particle production in inelastic electron-nucleon scattering. The modified phase-space integrals are calculated. The phase-space integrals calculated with the formula derived are compared with the phase-space integrals calculated by the Monte Carlo method or by the sequence method of the Belen'kij. (J.S.R.)

**44181** A FEW REMARKS ON PAULI MASTER EQUATIONS AND ONE-PARTICLE DISTRIBUTIONS. Fulinski, Andrzej (Jagellonian Univ., Krakow). Acta Phys. Pol., 29: 797-803(June 1966).

Some inconsistencies of the Pauli master equation for one-particle density matrix are discussed. It is shown, among other results, that in case of interactions between two different systems the validity of the Pauli equation is rather unclear. (auth)

**44182** THE SECOND CORRECTION TO THE PHASE INTEGRAL CALCULATED BY THE LURCAT AND MAZUR METHOD. Kajzar, Franciszek (Jagellonian Univ., Krakow). Acta Phys. Pol., 29: 911-13(June 1966).

The second correction to the phase-integral calculated by steepest descents method is given. The results are applied to the analysis of 10 Bev $\pi^-$p interactions. (auth)

**44183** CHARGE DISTRIBUTION OF PARTICLES IN A ONE-MESON THEORY OF INELASTIC INTERACTIONS AT HIGH ENERGIES. Barashenkov, V. S.; Truskova, N. F. (Joint Inst. for Nuclear Research, Dubna, USSR). Acta Phys. Pol., 30: 135-9(July 1966). (In Russian).

A simple method is offered for computing the charge distribution of particles produced by inelastic interactions at high energies. An analysis of inelastic $\pi^-$-p interactions at 7 Bev showed that the obtained data for one-meson polar interactions are in a good agreement with the experiment and are relatively insensitive to the variations in the assumptions for the little known cross sections of unstable $\pi + \pi$ and $\pi$ + K particle interactions. (tr-auth)

**44184** THE REACTION $\pi^+p \rightarrow \omega N^{*++}$ AT HIGH ENERGIES AND THE REGGE-POLE EXCHANGE MODEL. Golab, Zofia (Jagellonian Univ., Krakow). Acta Phys. Pol., 30: 339-40(Aug. 1966).

It is pointed out that the Reggeized $\rho$-exchange model cannot describe correctly all aspects of the reaction $\pi^+ + p \rightarrow \omega + N^{*++}$. It appears that the objections raised against the application of the $\rho$-Regge-pole exchange model for the reaction $\pi^+ + n \rightarrow \omega + p$ remain valid also for the reaction considered. It is concluded that the Reggeized $\rho$-exchange model does not describe correctly the spin correlations in the reaction $\pi^+ + p \rightarrow \omega + N^{*++}$ at the considered energies. (J.F.P.)

**44185** ON THE WAVE AND CORPUSCULAR PROPERTIES OF THE PHOTON. A CASE OF NON-RELATIVITY. Datzeff, A. (Sofia Univ.). Compt. Rend. Acad. Bulg. Sci., 19: 365-8(1966).

A treatment of the photon is proposed using a previous interpretation of quantum mechanics in which the existence of a material support of the field called the subvac was adopted. It was assumed that the subvac has a distinct structure and consists of AS particles from which all elementary particles can be built in principle. In order to introduce the photon a well-known analogy is made between optics and classical mechanics in which a wave is attached to the electron. This analogy is used in its inverse sense attaching the corresponding particle to a wave propagating in the material medium in which an electromagnetic process spreads. (J.F.P.)

**44186** A LOW-ENERGY P(1/2,1/2) RESONANCE IN THE CHEW-LOW MODEL. Bourrely, Claude (Univ., Paris, Marseille, France). Compt. Rend., Ser. B, 263: 227-9(July 18, 1966). (In French).

The pion-nucleon P-wave scattering is considered within the framework of the Chew-Low model using a new source function. It was found that a resonance in the state ($\frac{1}{2}$,$\frac{1}{2}$) at 1420 Mev exists next to the classic resonance ($\frac{3}{2}$,$\frac{3}{2}$). (tr-auth)

**44187** GEOMETRICAL CORRELATIONS IN PRODUCTION AND DECAYS OF ELEMENTARY PARTICLES. Sona, P. G. (CISE, Milan. Univ., Milan). Energ. Nucl. (Milan), 13: 505-7(Sept. 1966).

Some theoretical aspects of a geometrical correlation existing between the production of charged $K^-$ mesons or $E^+$ and their decays in an emulsion stack exposed to a beam of $K^+$ or $K^-$, which was suggested in a recent experiment by W. Z. Osborne, are discussed. Consideration is given to the spion hypothesis as an explanation, and other experiments similar to Osborne's are suggested. (L.B.S.)

**44188** COMPUTATION OF FORM FACTORS AND LONGITUDINAL POLARIZATION OF PARTICLE SPINS IN ELECTROMAGNETIC ANNIHILATION OF $p + \bar{p} \rightarrow \mu^- + \mu^+$. Yakhyaev, R. Sh.; Sadykhov, F. S. Izv. Akad. Nauk Azerbaidzh. SSR, Ser. Fiz.-Tekh. Mat. Nauk, No. 5, 123-7(1965). (In Russian).

The effective cross section for proton-antiproton annihilation was determined along with the effect of the form factors on the angular and energy distributions as well as on the longitudinal polarization of the spin correlations for all the particles involved. The differential and total cross sections for the $\mu^- + \mu^+$ annihilation of the $p\bar{p}$ pair are also given. (G.O.Y.)

**44189** INELASTIC p-p INTERACTIONS AT 2.26 Gev. Azimov, S. A.; Gulyamov, U. G.; Rakhimbaev, B. G.; Chernova, L. I. (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 54-7(1966). (In Russian).

Inelastic nucleon-nucleon interactions in an emulsion chamber were studied as a function of the square of the four-momentum transfer $\Delta^2$ with primary 2.26-Bev protons. Among the selected 148 events of inelastic p-p interactions 131 events were of the type n = 2, and 17 were of the type n = 4. The distribution of slow protons according to their kinetic energy in a laboratory system coordinate is given. It was found that the differential cross section increased with decreasing proton energy and reached the maximum near zero. For the $\Delta^2$ magnitude the ratio is $\Delta^2 = 2ME_p$. Thus, the proton energy determines the four momentum exchange in inelastic interactions. (R.V.J.)

**44190** BREMSSTRAHLUNG OF ELECTRONS WITH $\bar{E}$ = 2.4 Gev. Bem, J.; Grishin, V. G.; Ryabtsov, V. D. (Joint Inst. for Nuclear Research, Dubna, USSR). JETP Lett. (USSR) (Engl. Transl.), 4: 72-5(Aug. 1, 1966).

Translated from Zh. Eksperim. Teor. Fiz., Pis'ma Redakt., 4: 106-10(Aug. 1, 1966).

The bremsstrahlung of electrons with $\bar{E}$ = 2.4 Bev was investigated using a 24-liter propane chamber. 112 events of the type $e^- + z \rightarrow e^- + z + \gamma$ were identified, and the distributions of the obtained events are shown in comparison with theoretical calculations. (L.B.S.)

**44191** PHASE-SHIFT ANALYSIS OF NUCLEON-NUCLEON SCATTERING AT 400 Mev. Kazarinov, Yu. M.; Lehar, F.; Janout, Z. (Joint Inst. of Nuclear Research, Dubna, USSR). JETP Lett. (USSR) (Engl. Transl.), 4: 75-8(Aug. 1, 1966).

Translated from Zh. Eksperim. Teor. Fiz., Pis'ma Redakt., 4: 110-14(Aug. 1, 1966).

The results of a phase shift analysis in nucleon-nucleon scattering around 400 Mev are presented using data on triple-scattering polarization and parameters. (L.B.S.)

**44192** NEW METHOD OF INVESTIGATING THE MECHANISM OF NUCLEAR INTERACTIONS. Dremin, I. M.; Zhdanov, G. B.; Tret'yakova, M. I.; Chernyavskii, M. M. (Lebedev Inst. of Physics, Moscow). JETP Lett. (USSR) (Engl. Transl.), 4: 104-7(Aug. 15, 1966).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Redaktsiyu, 4: 152-6(Aug. 15, 1966).

An analysis of inelastic interactions at high energies, relative to the square of the four-momentum transferred to the different groups of particles, in conjunction with an additional analysis of the effective masses of these groups is the basis of a method for the interpretation of individual events, i.e., for the separation of central and peripheral interactions, for the investigation of different types of the

l correlation
$K^-$ mesons or
xposed to a
a recent ex-
Consideration
nation, and
e suggested.

TORS AND
TICLE SPINS
OF $p + \bar{p} \to$
. Izv. Akad.
t. Nauk, No. 5,

tiproton anni-
ct of the form
ons as well as
correlations for
and total cross
$\bar{p}$ pair are also

AT 2.26 Gev.
v, B. G.; Cher-
emy of Sci-
R, Ser. Fiz.-

n emulsion
uare of the
26-Bev pro-
stic p-p in-
and 17 were
otons ac-
y system
ferential cross
rgy and
magnitude the
determines
ractions.

ONS WITH
sov, V. D.
R). JETP
1966).
Pis'ma

.4 Bev was
. 112 events
, and the
in com-

LEON-
inov, Yu. M.;
Research,
sl.), 4:

Pis'ma

on-nucleon
data on
(L.B.S.)

THE
Dremin,
nyavskii,
ETP Lett.
.
a Redakts-

nergies,
nsferred
on with an
ese groups
individual
ripheral
pes of the

---

latter, and for setting up a suitable Feynman diagram in correspondence with each event. A pellicle stack was exposed to a beam of 24-Bev/c protons, and from these 51 pure events (having two protons in the final state) were processed and analyzed. The results of an analysis of the square of the four-momentum transfer plots for these events are given. A somewhat arbitrary boundary between peripheral and central interactions is drawn at 1 $Bev^2/c^2$. (J.F.P.)

**44193** SYMMETRY OF THE TIME AXIS. **Stannard, F. R. (Univ. Coll., London). Nature, 211: 693-5(Aug. 13, 1966).**

The question: "If the time axis were perfectly symmetric with respect to all the laws of Nature, how would the world appear to us?" is considered. Matter of the opposite time sense is designated as "faustian." Interactions between particles in faustian states would be identical in every respect to interactions between our own particles, except that their time asymmetry would be reversed. It is proposed that evidence for this theory may be found in the study of the lifetime of the $K_1^0$, and $\Lambda^0$, and $\Xi^0$ particles. (M.H.R.)

**44194** MUON CAPTURE BY $^3$He. **Pascual, R.; Pascual, P. (Univ., Valencia). Nuovo Cimento (10), 44B: 434-51(Aug. 11, 1966).**

The partial capture rate $\mu^- + {}^3He \to {}^3H + \nu$ was calculated, including relativistic terms. For the nuclear wave functions a superposition of seven states, including isospin-$^3/_2$ terms was used. The amplitudes of these states are discussed. (auth)

**44195** SEARCH FOR A BARYON OF POSITIVE STRANGENESS. **Bomse, F.; Borenstein, S.; Cole, J.; Ellis, D.; Gillespie, E.; Luste, G.; Moses, E.; Pevsner, A.; Zdanis, R. (Johns Hopkins Univ., Baltimore). Nuovo Cimento (10), 45A: 29-37(Sept. 1, 1966).**

A search was made for a baryon of strangeness +1 (the $Z^+$) in the mass range from 940 to 1440 $Mev/c^2$. Three production modes were considered: $K^+ + p \to Z^+ + \pi^+$, $K^+ + p \to Z^+ + \pi^+ + \pi^0$, $\pi^+ + d \to Z^+ + \bar{K}^0 + p$. Candidates for the first two reactions came from a 2.26 Bev/c $K^+p$ bubble chamber experiment and were of two types: all 2-prong events in which one track decayed in the chamber and a sample of nondecaying 2-prongs in which there was no apparent neutral production (as determined by the momentum balance at the production vertex). The associated production events were taken from $\pi^+d$ exposures at 1.2 and 2.8 Bev/c. In all cases the data are consistent with the absence of a $Z^+$, although kinematic ambiguities of various types prevent an absolute statement. In the $K^+$-initiated reactions, the production cross sections are less than 1 $\mu$b for the 2-body production of the decaying $Z^+$, less than 3 $\mu$b for the 3-body production of the decaying $Z^+$, and less than 25 $\mu$b for a $Z^+$ which does not have a visible decay (with reasonable assumptions on the ambiguities). The associated production cross section for a $Z^+$ is less than 18 $\mu$b. (auth)

**44196** THEORY OF DEUTERON PRODUCTION IN PROTON-PROTON COLLISIONS. **Chahoud, J. N.; Russo, G.; Selleri, F. (Univ., Bologna. Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo Cimento (10), 45A: 38-57(Sept. 1, 1966).**

A dynamical model is presented for the reaction $p + p \to d + \pi^+$ based on the assumption that its amplitudes are dominated by graphs with anomalous thresholds. The predictions of the model are calculated and found to be in good agreement with experiments. (auth)

**44197** BOOTSTRAP SOLUTIONS TO THE BETHE-SALPETER EQUATION. **Harte, J. (CERN, Geneva). Nuovo Cimento (10), 45A: 179-204(Sept. 1, 1966).**

A bootstrap dynamics based on the properties of the Bethe-Salpeter equation is developed. Bootstrap conditions are derived from the Bethe-Salpeter bound-state wave-function equation and the normalization on the wave function under the assumption that the interaction kernel is given by the exchange of the bound state. As in N/D bootstraps, tractable equations result only if cross symmetry is violated. It is shown that the bootstrap conditions generalize in a very simple manner to the case of interacting Lie group multiplets of particles. Some applications of the bootstrap dynamics are given for the case of meson bound states in the fermion-antifermion channel; for reasons of mathematical convenience, only massless mesons are treated here. Arguments are given to suggest that this model might provide a relativistic description of meson bound states in a massive quark model. (auth)

**44198** W-SPIN CONSTRAINTS ON EVENTUAL C-VIOLATING ELECTROMAGNETIC INTERACTIONS. **Buccella, F. (Univ., Florence). Nuovo Cimento (10), 45A: 225-9(Sept. 1, 1966).**

Restrictions on C-violating electromagnetic interactions are discussed following from the assumption that the electric monopole part and the magnetic part of the electromagnetic current transfer under $SU_{6W}$ respectively as the members W = 0 and W = 1 with U = 0 of the regular representation. The consequences of $SU_3$ breaking which reduces the symmetry for $SU_{6W}$ to $[SU_4 \times SU_2]_W$ are also discussed. A statement is also made on the consistency between W-spin symmetry and CT invariance. (L.B.S.)

**44199** QUARK MODEL AND S-WAVE NONLEPTONIC HYPERON DECAYS. **Chan, F. C. (Univ. of Colorado, Boulder). Nuovo Cimento (10), 45A: 236-8(Sept. 1, 1966).**

The nonleptonic decay of hyperons in connection with the s-wave amplitude is studied in the framework of the quark model, assuming that one quark makes the transition with a $\pi$ emission. The decay matrix elements are calculated in terms of the quark matrix elements and the results are tabulated. (L.B.S.)

**44200** PION DECAYS IN THE STATIC QUARK MODEL. **Kummer, W. (Inst. for High Energy Physics, Vienna); Kuti, J. Nuovo Cimento (10), 45A: 242-4(Sept. 1, 1966).**

Some consequences of the static quark-model hypothesis which cannot be obtained by symmetry considerations are discussed; in particular, the quark-antiquark structure of mesons is considered. It is shown that the quark model of mesons is compatible with the annihilation decays in terms of reasonable values of the parameters; the vanishing of the intrinsic strong axial vector contribution may give particular support to the static quark model. (L.B.S.)

**44201** RESONANCE TAILS AND HIGH-ENERGY $\pi$N CHARGE EXCHANGE. **Phillips, R. J. N. (Atomic Energy Research Establishment, Harwell, Eng.). Nuovo Cimento (10), 45A: 245-8(Sept. 1, 1966).**

It is shown that the tails of s-channel resonances, added as a background to the $\rho$ Regge-pole amplitude, can produce significant polarization in high-energy $\pi$-N charge-exchange interactions. (L.B.S.)

**44202** NOTE ON DOUBLE BREMSSTRAHLUNG. **di Vecchia, P. (CNEN, Frascati, Rome). Nuovo Cimento (10), 45A: 249-51(Sept. 1, 1966).**

The double bremsstrahlung process $e^+ + e^- \to e^+ + e^- + 2\delta$ is considered as a possible monitoring process defined as a collision process between electrons and positrons in which the momentum transfer could be considered sufficiently small to justify the assumption that their description could be given by quantum electrodynamics with unit form factors and unmodified propagators. Various factors which seem to favor its adoption as a monitoring process are pointed out. (L.B.S.)

**44203** DECAY WIDTHS AND MAGNETIC MOMENTS OF VECTOR MESONS IN RELATIVISTIC $SU_6$. **Chan, F. C. (Ohio State Univ., Columbus). Nuovo Cimento (10), 45A: 259-62(Sept. 1, 1966).**

The radiative decay widths and magnetic moments of vector mesons are investigated in relativistic $SU_6$ theory. The effective trilinear meson-meson vertex described by the interaction Lagrangian in the lowest order perturbation is considered, from which the VPP, VVP and VVV interactions are derived. The decay modes and widths are tabulated, and the total magnetic moments of $\rho^+$ and $K^{*+}$ are obtained. (L.B.S.)

**44204** $X^0$-PHOTOPRODUCTION IN THE REGGE-POLE MODEL. Drechsler, W. (Univ., Heidelberg). Nuovo Cimento (10), 45A: 263-7(Sept. 1, 1966).

The possible contribution of Regge poles in photoproduction of the $SU_3$ singlet scalar meson $X^0$(1958) is discussed. Preliminary experimental data on the total cross section for $\gamma + p \rightarrow p + X^0$ indicate a relatively strong $X^0$ production shortly above threshold and a quick decrease with increasing $\gamma$ energy. It is shown that such a behavior can easily be attributed to a contribution of $\rho$-exchange in the Regge picture. The hypergeometric functions appearing are computed explicitly without using asymptotic expansions. (L.B.S.)

**44205** ON THE $\eta \rightarrow \pi^0\gamma\gamma$ DECAY MODE. Alles, W. (Istituto Nazionale di Fisic a Nucleare, Bologna); Baracca, A.; Ramos, A. Tiemblo. Nuovo Cimento (10), 45A: 272-4(Sept. 1, 1966).

The $\eta \rightarrow \pi^0\gamma\gamma$ and $\eta \rightarrow \gamma\gamma$ decay modes are calculated using the Gell-Mann, Sharp and Wagner model and assuming that $\eta$ is a member of an octet. No version of the model leading to $(\eta \rightarrow \pi^0\gamma\gamma)/(\eta \rightarrow \gamma\gamma) \sim 1$ could be found that did not give a large discrepancy for the $(\eta \rightarrow \pi^+\pi^-\gamma)/(\eta \rightarrow \gamma\gamma)$ ratio, when only the $\eta$-X and $\omega$-$\varphi$ mixing are considered for breaking $SU_3$. (L.B.S.)

**44206** POSSIBLE VANISHING OF STRONG INTERACTION CROSS-SECTION AT INFINITE ENERGIES. Cabibbo, N. (CERN, Geneva); Kokkedee, J. J. J.; Horwitz, L.; Ne'eman, Y. Nuovo Cimento (10), 45A: 275-80(Sept. 1, 1966).

The vanishing of strong-interaction total cross sections at infinite energies is suggested on the basis of an algebraic interpretation of the Regge-pole model. Elastic amplitudes in the forward direction are computed and a good fit to experimental data was obtained. Some results are given for $\pi^+p$, $\pi^-p$, pp, and $\bar{p}p$ interactions. (L.B.S.)

**44207** ANOMALOUS MAGNETIC MOMENT OF THE NEGATIVE MUON. Farley, F. J. M.; Bailey, J.; Brown, R. C. A.; Giesch, M.; Joestlein, H.; van der Meer, S.; Picasso, E.; Tannenbaum, M. (CERN, Geneva). Nuovo Cimento (10), 45A: 281-6(Sept. 1, 1966).

An experiment is described using the magnetic storage ring in which a preliminary measurement of the anomalous magnetic moment of the negative muon yielded $(1165 + 3) \times 10^{-6}$. The new device offers the possibility of an order-of-magnitude improvement in accuracy. (L.B.S.)

**44208** ELECTROMAGNETIC INELASTIC VERTEX. Micheli, J. (Faculte des Sciences, Orsay, France). Nuovo Cimento (10), 45A: 312-26(Sept. 21, 1966).

The inelastic electromagnetic vertex is studied for arbitrary spin particles. This is done in a particular Lorentz frame in order to relate the form factors to the transition multipole moments for radiative transitions. Then the general form of the electron-nucleus cross section is calculated in function of these form factors. (auth)

**44209** NONRELATIVISTIC NUCLEON-NUCLEON POTENTIAL FROM S-MATRIX THEORY. II. Cirelli, R. (Univ., Milan. Istituto Nazionale di Fisica Nucleare, Milan); Montaldi, E.; Prosperi, G. M. Nuovo Cimento (10), 45A: 381-425(Sept. 21, 1966).

The problem of the construction of a nonrelativistic nucleon-nucleon potential by dispersive technique already treated for a model of two scalar nucleons is now considered for realistic spin-½ nucleons. Assuming an asymptotic behavior in s for the relativistic amplitude as suggested by the consideration of the Regge trajectories that are supposed to be dominant in the range of t of interest, a velocity- and spin-dependent potential is obtained which generalizes the preceding result. The procedure used gives the potential in terms of certain subtraction constants occurring in the relativistic dispersion relations. Explicit expressions are given for $t < 9\,\mu^2$ while numerical calculations should be necessary for larger ranges of t. (auth)

**44210** RELATIVISTIC IMPULSE APPROXIMATION FOR $\pi$-d ELASTIC SCATTERING. Chahoud, J. N.; Russo, G. (Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo Cimento (10), 45A: 493-500(Sept. 21, 1966).

The impulse approximation method to handle with scattering problems on bound states is re-examined from the dispersion theory point of view. Explicit calculations are performed for the elastic scattering of pions on deuterons. The general features of the experimental data are well reproduced notwithstanding the drastic approximations proposed. (auth)

**44211** CURRENT COMMUTATION RELATIONS AND MESON PHOTOPRODUCTION NEAR THRESHOLD. De Baenst, P.; Konuma, M.; Weyers, J. (Univ. of Louvain, Belg.). Nuovo Cimento (10), 45A: 501-4(Sept. 21, 1966).

The photoproduction of mesons on nucleons near threshold is treated using the algebra of current commutation relations and the hypothesis of partially conserved axial-vector current. Relations for the transition matrix elements are obtained, and encouraging results are found in comparison with experiment. (L.B.S.)

**44212** THEORY OF THE MULTIPLE SCATTERING IN AN INHOMOGENEOUS MEDIUM. Kalashnikov, N. P. (Univ., Bologna). Nuovo Cimento (10), 45A: 510-12 (Sept. 21, 1966).

The multiple scattering of fast charged particles is considered in an inhomogeneous medium such as a nuclear emulsion. The influence of the inhomogeneities on the value of the mean square of the lateral deflection is explored and the attempt is made to explain the so-called spurious scattering. (L.B.S.)

**44213** STRUCTURE MODEL OF THE HADRONS. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 103-12(May 1966). (In Chinese).

The concept of a structural model of hadron interactions is discussed. The development of the theory of symmetry, the proposal of the structural model, and the major results derived from the model are included. (JPRS)

**44214** ELECTROMAGNETIC FORM FACTORS OF THE $\frac{1}{2}^+$ BARYONS ACCORDING TO THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 137-49(May 1966). (In Chinese).

In the present paper the electromagnetic interaction of the hadrons is reduced to the interaction of the basic particles with the electromagnetic field. The connection between the electromagnetic form factors and the inner structure of the hadrons is also explained. The calculated results agree very well with the experiment. Especially satisfactory is the explanation of the nonvanishing charge radius of the neutron which cannot be explained by the quantum field theory based on the point particle model and the phenomenological symmetry theories. The curves for the structure form factors $N(q^2)$ and $T(q^2)$ derived from the experimental curves of $G_M^p(q^2)$ and $G_M^n(q^2)$ are also given. (JPRS)

**44215** WEAK INTERACTION WITH LEPTONS OF THE $\frac{1}{2}^+$ BARYONS IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 150-61(May 1966). (In Chinese).

The leptonic weak interactions of the $\frac{1}{2}^+$ baryons are discussed and six weak interaction form factors $F_i(q^2)$ and $B_i(q^2)$ are obtained from the structure model of the hadrons by the covariant field theoretical calculations. The connection of these form factors with the masses in the initial and final states and the structure functions $N(q^2)$ and $T(q^2)$ is completely determined. The relations between the electromagnetic and the weak form factors are also given. The result may thus be compared with the experiment. The calculated values of the branching ratios of the electronic decays of various baryons agree very well with the experiment. The correction due to $T(q^2)$ amounts to 8%, the correction due to mass differences in the initial and final states amounts to 2%. It is expected that these corrections may be important in other weak processes. (JPRS)

**43216** DECAY OF THE $N^{*+} \rightarrow \gamma + p$ IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 167-75(May 1966). (In Chinese).

This paper gives a covariant field-theoretical discussion of the process $N^{*+} \rightarrow \gamma + p$, with the hadrons considered as composite particle with internal structure. The value of $SU_6$-breaking structure form factor T(0) obtained from experimental $E_{1+}/M_{1+}$ value for photoproduction of mesons is $-0.030$, agreeing in sign and order of magnitude with that obtained from experiments on the electric form factor of neutron. The magnetic dipole transition amplitude for the $\gamma + N \rightarrow \pi + N$ process so obtained is slightly larger than results in $SU_6$. The probability of decay calculated here are compared with experiments. (JPRS)

**43217** DECAY OF THE $\Omega^- \rightarrow \Xi^0 + l^- + \tilde{\nu}$ IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 176-82(May 1966). (In Chinese).

Using the covariant field-theoretical method of the structure model, the rate of the process $\Omega^- \rightarrow \Xi^0 l^- \tilde{\nu}$ is calculated. When $T = -0.060$, $W_{tot}(\Omega^- \rightarrow \Xi^0 e^- \tilde{\nu}) = 6.32 \times 10^7$ sec$^{-1}$, $W_{tot}(\Omega^- \rightarrow \Xi^0 \mu^- \tilde{\nu}) = 6.44 \times 10^7$ sec$^{-1}$ and when $T = -0.030$, $W_{tot}(\Omega^- \rightarrow \Xi^0 e^- \tilde{\nu}) = 6.64 \times 10^7$ sec$^{-1}$, $W_{tot}(\Omega^- \rightarrow \Xi^0 \mu^- \nu) = 6.65 \times 10^7$ sec$^{-1}$. The main contribution is provided by the pseudovector current of the basic particles. The pseudoscalar constant is fixed by $\mu$-capture experimental data. For the process $\Omega^- \rightarrow \Xi^0 e^- \tilde{\nu}$ the contribution of the pseudoscalar current of the basic particles may be neglected, but for the process $\Omega^- \rightarrow \Xi^0 \mu^- \tilde{\nu}$, this contribution is very large. These results can not be obtained from the usual phenomenological $SU_3$ theory. (JPRS)

**44218** EFFECTIVE MASS OF THE BASIC PARTICLES IN BOUND STATES. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 225-9(May 1966). (In Chinese).

The possibility that the mass of the basic particles in bound states is smaller than that in free states is discussed from the stand point of Bethe-Salpeter equation. It is shown that the effective reduction of mass may be understood by using a new interaction representation followed by a Hilbert-Poincaré transformation. The new interaction representation is so chosen that the free particle has the effective mass. (JPRS)

**44219** ROTATIONAL EXCITED STATES OF THE ELEMENTARY PARTICLES. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 230-6(May 1966). (In Chinese).

The six independent coordinates in the center of mass system for the baryon consisting of three basic particles are separated into three external and three internal coordinates. The external wave function is an eigenfunction of angular momentum. The energy of rotational excitation may be estimated by a perturbation calculation. The result obtained is consistent with the view that the $7/2^+$ and $5/2^+$ baryons are rotational excited states of $3/2^+$ and $1/2^+$ baryons respectively. Similar consideration can be extended to the meson system and it is shown that the $2^+$ mesons may be considered as the rotational excited state of the $1^-$ mesons. The energy of excitation is of the order of magnitude 600 Mev for all cases. (JPRS)

**44220** INDIVIDUAL-PARTICLE APPROXIMATION OF HIGHER-EXCITED STATES. Liu, Yao-yang. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 237-41(May 1966). (In Chinese).

Using an effective individual-particle approximation the energy levels of the higher-excited states of the elementary particles are discussed and a comparison with the experimental data is made. The result is compatible with the experiment qualitatively. The radii are determined to be 0.60 F for the mesons and 0.67 F for the baryons. (JPRS)

**44221** A QUARK MODEL DERIVATION OF MESON-BARYON COUPLING CONSTANT RELATIONS. Rivers, R. J. (International Center for Theoretical Physics, Trieste, Italy). Phys. Lett., 22: 514-16(Sept. 1, 1966).

Using a simple quark model for baryon-meson vertices coupling constant relations are derived, which under certain circumstances are the same as those derived from current algebra. (auth)

**44222** THE $\rho'$ TRAJECTORY AND ITS CONTRIBUTION TO NN AND $\pi$N CHARGE EXCHANGE SCATTERING. Hoegaasen, H.; Fischer, W. (CERN, Geneva). Phys. Lett., 22: 516-19(Sept. 1, 1966).

The zero intercept of a $\rho'$ Regge trajectory is determined from experimental data on nucleon-nucleon collisions. A neat explanation of the positive polarization in $\pi^- p \rightarrow \pi^0 n$ is presented. (auth)

**44223** CONNECTION BETWEEN DISPERSION RELATIONS AND CURRENT ALGEBRAS. Kallosh, R. E. (Lebedev Physical Inst., Moscow). Phys. Lett., 22: 519-20(Sept. 1, 1966).

It is shown that dispersion relations are sufficient for obtaining the sum rule for electroproduction and the Cabibbo-Radicati relation without use of current algebra. (auth)

**44224** COMPARISON OF QUARK MODEL PREDICTIONS WITH EXPERIMENT FOR $\bar{p}p$ ANNIHILATION. Kirz, J. (Univ. of California, Berkeley). Phys. Lett., 22: 524-5(Sept. 1, 1966). (UCRL-16934).

Predictions for $\bar{p}p$ annihilation, based on a quark model, are compared with experimental data. The model fails to give a quantitative description of the reaction. (auth)

**44225** RADIATIVE CORRECTIONS TO ELECTROPRODUCTION OF PIONS. Urban, P.; Widder, F. (Univ., Graz). Phys. Lett., 22: 526-8(Sept. 1, 1966).

Numerical results of the radiative corrections ($\delta$) to electroproduction of pions with the out-coming charged particles detected in coincidence are presented. $\delta$ is given as a function of kinematics (momentum transfer) and of energy- and angle-resolution of the detected particles. (auth)

**44226** DECAY ANGULAR DISTRIBUTIONS OF RESONANCES IN TWO-BODY REACTIONS PRODUCED BY 8 Gev/c POSITIVE PIONS ON PROTONS. Crijns, F. (Technische Hochschule, Aachen); Deutschmann, M.; Schmitz, P.; (and others). Phys. Lett., 22: 533-6(Sept. 1, 1966).

The decay angular distributions of resonances produced in 8 Bev/c $\pi^+ p$ interactions were analyzed in terms of density-matrix elements and, in a case of double resonance production, in terms of angular correlations between the decay of the two resonances. The results are compared with the predictions of the absorption model. In general, fair agreement is found, although discrepancies are observed in some cases. (auth)

**44227** THE CHARGE EXCHANGE $\bar{p}p \rightarrow \bar{n}n$ AT 5, 6, 7 AND 9 Gev/c. Astbury, P. (CERN, Geneva); Brautti, G.; Finocchiaro, G.; (and others). Phys. Lett., 22: 537-9 (Sept. 1, 1966).

The reaction $\bar{p}p \rightarrow \bar{n}n$ was studied with a magnet spark chamber system. The results obtained on the total cross section at 5, 6, 7, and 9 Bev/c and on the differential cross section at 7 Bev/c are given. (auth)

**44228** DECAY OF THE $K^0$ MESON INTO THREE PIONS: TEST OF CP CONSERVATION AND $\Delta I = 1/2$ NON-LEPTONIC SELECTION RULE. Behr, L. (Ecole Polytechnique, Paris); Brisson, V.; Petiau, P.; (and others). Phys. Lett., 22: 540-2(Sept 1, 1966).

CP invariance and $\Delta I = 1/2$ rule are tested by analyzing 136 $K^0$ decays of the type $K^0 \rightarrow \pi^+\pi^-\pi^0$ and 54 of the type $K^0 \rightarrow \pi^0\pi^0\pi^0$ observed in a heavy liquid bubble chamber. There is no evidence against either hypothesis. (auth)

**44229** NEW $T \geq 1$ Di-PION AT 965 Mev. Allen, D. D.; Fisher, G. P.; Godden, G.; Marshall, L.; Sears, R. (Univ. of Colorado, Boulder). Phys. Lett., 22: 543-5 (Sept. 1, 1966).

Evidence is presented for a dipion enhancement of mass 965 Mev having $T \geq 1$, from negative pion-proton interactions at 1.7 Bev/c with single pion production. Compared with $\rho$ production this enhancement is produced very weakly at low four-momentum transfer but appears to become comparable in production probability for $\Delta_1^2 > 0.5$ (Bev/c)$^2$. (auth)

**44230** TEST OF C INVARIANCE IN THE THREE PION DECAY OF THE $\eta$ MESON. Cnops, A. M. (CERN, Geneva); Finocchiaro, G.; Lassalle, J. C.; Mittner, P.; Dufey, J. P.; Gobbi, B.; Pouchon, M. A.; Muller, A. Phys. Lett., 22: 546-50(Sept. 1, 1966).

The study of the decay distribution of a sample of 10,665 $\eta \rightarrow \pi^+\pi^-\pi^0$ observed in a magnet spark chamber experiment shows no evidence for charge conjugation violation. The result for the right to left asymmetry in the Dalitz plot is 0.3% with a statistical error of ±1%. (auth)

**44231** ELASTIC SCATTERING OF POLARIZED DEUTERONS BY DEUTERIUM AT 21.4 Mev. Arvieux, J.; Goudergues, J.; Mayer, B.; Papineau, A. (Centre d'Etudes Nucleaires, Saclay, France). Phys. Lett., 22: 610-11 (Sept. 15, 1966).

Angular distributions of polarized deuterons scattered from deuterium were measured for an incident energy of 21.4 Mev. Vector and tensor polarization parameters are presented. (auth)

**44232** IONIZATION LOSS BY RELATIVISTIC ELECTRONS. Smith, A. M.; Stewart, D. T. (Univ. of Glasgow). Phys. Lett., 22: 633-5(Sept. 15, 1966).

The ionization loss of relativistic electrons in the energy range 20−150 Mev was studied in CsI, Ne102A, and an argon-methane mixture. No support was found for Tsytovich's radiative corrections to energy loss. (auth)

**44233** MEASUREMENT OF THE PARAMETERS D AND R' IN PROTON-DEUTERON TRIPLE ELASTIC SCATTERING. Poulet, M.; Michalowicz, A.; Kuroda, K.; Cronenberger, D.; Coignet, G. (Institut de Physique Nucleaire, Orsay, France). Phys. Lett., 22: 636-7(Sept. 15, 1966). (In French).

Parameters D and R' in p-d elastic scattering were measured at 135 Mev, 20−60° lab. angular range. The results are compared with theoretical calculations using the impulse approximation and nucleon-nucleon scattering amplitudes. (auth)

**44234** BACKWARD COMPTON SCATTERING AT HIGH ENERGIES. Frolov, G. V.; Gorshkov, V. G.; Gribov, V. N. (Ioffe Inst. of Physics and Tech., Leningrad). Phys. Lett., 22: 662-4(Sept. 15, 1966).

The single logarithmic terms are taken into account in the asymptotics of the backward Compton scattering amplitude. The resulting expression has all the peculiar features, predicted by the Regge pole hypothesis. (auth)

**44235** DIFFICULTIES OF THE STATIC QUARK MODEL IN THE CASE OF THE $\eta$-DECAYS. Moebius, P.; Pietschmann, H. (Univ., Vienna). Phys. Lett., 22: 684-5 (Sept. 15, 1966).

Computing the decays of the $\eta$ into $2\gamma$ and $2\pi + \gamma$ in the framework of the static quark model, the total width results in a few kev, while the decays into $\pi^+\pi^-\pi^0$, $3\pi^0$ and $2\gamma + \pi^0$ give a width which is $10^3$ times smaller. (auth)

**44236** BACKWARD $\pi^+$p ELASTIC SCATTERING FROM A DIRECT CHANNEL $\Delta_\delta$ RESONANCE MODEL. Barger, V.; Cline, D. (Univ. of Wisconsin, Madison). Phys. Lett., 22: 666-8(Sept. 15, 1966).

The available experimental data on backward $\pi^+$p elastic scattering in the angular region of $\cos\theta = -0.94$ to $\cos\theta = -1$ for laboratory momenta of 400 Mev/c to 4 Bev/c are adequately explained by direct channel contributions of known $I = 3/2$ resonances. Comparison with the data requires positive parities for the $I = 3/2$ resonances at 2450 and 2850 Mev in agreement with $\Delta_\delta$ Regge recurrence assignments. (auth)

**44237** BRANCHING RATIO PREDICTIONS FOR HIGH ENERGY REACTIONS INVOLVING STRANGE PARTICLES. Ahmadzadeh, A. (Univ. of California, San Diego, La Jolla). Phys. Lett., 22: 669-71(Sept. 15, 1966).

From a combination of SU(3) symmetry and exchange degeneracy in the Regge pole model, a new set of simple branching ratios are predicted. These ratios are experimentally accessible, and their measurement would offer very valuable tests of how accurately the exchange degeneracy formalism holds. (auth)

**44238** $K_{\mu2}(\pi_{\mu2})$ DECAY AND $\rho$ MESON UNIVERSALITY. Sakurai, J. J. (Univ. of Chicago). Phys. Lett., 22: 689-90(Sept. 15, 1966).

It is shown that, even in the badly broken eightfold way, the $K_{\mu2}$ decay rate is still given by Cabibbo's theory as long as the $U(3) \otimes U(3)$ commutation relations are exact and the $\rho$ meson is coupled universally to the isospin. (auth)

**44239** PHOTOPRODUCTION PROCESSES IN THE QUARK MODEL. Kupsch, J. (Univ., Bonn). Phys. Lett., 22: 690-2(Sept. 15, 1966).

Photoproduction of mesons and of baryon resonances on nucleons is calculated in the independent quark model using impulse approximation. Several equalities between cross sections are derived. (auth)

**44240** REGGEIZED VECTOR MESON EXCHANGE FOR NEUTRAL PION-PHOTOPRODUCTION. Locher, M. P.; Rollnik, H. (Physikalisches Institut, Bonn). Phys. Lett., 22: 696-9(Sept. 15, 1966).

The predictions of reggeized vector meson exchange in $\gamma p \rightarrow p\pi^0$ are discussed. For t small, the calculated $\omega^-$ exchange agrees with available data. The theoretical minimum at $t = -0.6$(Bev/c)$^2$ is tentatively removed at 2 Bev by a resonant background. (auth)

**44241** STRUCTURES IN THE 4 $\pi$ MASS SYSTEM IN THE REACTION $\pi^-p \rightarrow p\pi^-\pi^+\pi^-\pi^0$ AT 11 Gev/c. Conte, F. (INFN, Genoa); Tomasini, G.; Dittmann, P.; (and others). Phys. Lett., 22: 702-4(Sept. 15, 1966).

Evidence is presented for an enhancement in the mass distribution of a charged $4\pi$ system at about 1.68 Bev and width of ≈160 Mev, associated predominantly with a $\rho\pi\pi$ structure. The interpretation as $4\pi$ decay of the g meson with $I = 1$ seems to be favored. Furthermore two different mechanisms for the production of the $\omega$ meson seem to be present, one of which is connected with the B effect. (auth)

**44242** SINGLE PHOTOPRODUCTION OF NEUTRAL $\pi$-MESONS ON HYDROGEN AT SMALL ANGLES BETWEEN 1.3 AND 3 Gev. Braunschweig, M.; Husmann, D.; Luebelsmeyer, K.; Schmitz, D. (Univ., Bonn. Kernforschungsanlage, Juelich, Ger.). Phys. Lett., 22: 705-8(Sept. 15, 1966).

The differential cross section of the reaction $\gamma + p \rightarrow p + \pi^0$ was measured using an electron synchrotron at mean photon energies of 1.36, 2.0 and 3.0 Bev and pion center of mass angles between 0 and 70°. The results are compared with some theoretical calculations based on elementary and reggeized $1^-$ meson exchange. (auth)

**44243** PRODUCTION OF ISOSPIN 1 RESONANCES IN THE REACTION P + P = D + (MISSING MASS). Oostens, J. (Departement de Physique des Particules Elementaires, Saclay, France); Chavanon, P.; Crozon, M.; Tocqueville, J. Phys. Lett., 22: 708-10(Sept. 15, 1966).

Evidence for the existence of a narrow nonstrange resonance is presented. Its mass is 966 ± 10 Mev and its width is estimated to be less than 10 Mev. Its isospin is 1 and it is positively charged. (auth)

**44244** $K^0$-p INTERACTIONS AND S-WAVE KAON-NUCLEON SCATTERING LENGTHS. Donald, R. A.; Edwards, D. N.; Lys, J.; Nisar, T.; Moore, R. S. (Univ. of Liverpool). Phys. Lett., 22: 711-13(Sept. 15, 1966).

The elastic and absorptive scattering of low momentum neutral kanons in liquid hydrogen was used to provide additional information concerning the kaon-nucleon scattering lengths. The ambiguous solutions of Kim and of Sakitt are well resolved. (auth)

**44245** STRUCTURE WITHIN THE R(1675) BOSON AND POSSIBLE STRUCTURE WITHIN THE $A_2$(1290). Levrat, B.; Tolstrup, C. A.; Schuebelin, P.; Nef, C.; Martin, M.; Maglic, B. C.; Kienzle, W.; Focacci, M. N.; Dubal, L.; Chikovani, G. (CERN, Geneva). Phys. Lett., 22: 714-18(Sept. 15, 1966).

Three narrow peaks with masses 1632 ± 15, 1700 ± 15 and 1748 ± 15, referred to as $R_1$, $R_2$ and $R_3$, were observed in missing-mass spectrometer runs at incident pion momenta of 7 and 12 Bev/c and a mass-resolution of ±15 Mev. One-peak hypothesis gives a confidence level $P(\chi^2) = 0.8\%$; the three-peak one gives $P(\chi^2) = 60\%$. Statistical significance for $R_1$, $R_2$ and $R_3$ is, respectively, 3.8, 6.6 and 6.1 standard deviations from the highest background line. $R_1$ and $R_2$ decay into one and three, while the $R_3$ decays mainly into three charged particles. Their physical widths are compatible with zero, with upper limits of the order of $\Gamma \leq 30$ Mev. An apparent two-peak structure is observed within the $A_2(1286)$ peak, with the mass-values 1260 and 1312 Mev, at incident pion momenta of 6 and 7 Bev/c. The one-peak and two-peak hypotheses give the same confidence level $P(\chi^2) = 5\%$. (auth)

**44246** POSITRON ANNIHILATION IN HELIUM. Drachman, Richard J. (Goddard Space Flight Center, Greenbelt, Md.). Phys. Rev., 150: 10-14(Oct. 7, 1966).

The modified adiabatic scattering function previously used to compute phase shifts for positron-helium scattering below the positronium threshold is applied to the problem of annihilation in helium. A large enhancement factor relative to the Dirac rate is found, varying with energy from 2.30 to 3.16. The probability of finding the spectator electron in states of the $He^+$ ion other than the ground state is computed and found to be small but probably observable. (auth)

**44247** LADDER CORRECTIONS TO THE STATIC RANDOM-PHASE-APPROXIMATION DIELECTRIC CONSTANT AND TO POSITRON ANNIHILATION IN METALS. Crowell, Julian; Anderson, V. E.; Ritchie, R. H. (Oak Ridge National Lab., Tenn.). Contract W-7405-eng-26. Phys. Rev., 150: 243-8(Oct. 7, 1966). (ORNL-P-2042).

A calculation of the static dielectric constant of a free-electron gas is made in which account is taken of repeated (ladder) electron-hole interactions. An analytic approximation is given for the results. The effective interaction thus obtained is used in a high-order (ladder) perturbation calculation of the two-photon annihilation rate of positrons in an electron gas. The results agree quite well with experimental data for $r_s \leq 5$. Comparison is made with similar calculations made using the static random-phase-approximation and Hubbard interactions. (auth)

**44248** $\pi^+p$ ELASTIC DIFFERENTIAL CROSS SECTIONS FROM 2.3 TO 4.0 Gev/c. Coffin, C. T.; Dikemen, N.; Ettlinger, L.; Meyer, D.; Saulys, A.; Terwilliger, K.; Williams, D. (Univ. of Michigan, Ann Arbor). Phys. Rev. Lett., 17: 458-61(Aug. 22, 1966).

Differential elastic scattering cross sections for $\pi^+p$ scattering between 2.3 and 4 Bev are reported which give information on the sharp peaks corresponding to scattering in the backward direction which have been observed in both $\pi^+$- and $\pi^-$-p scattering at 3.5 to 8 Bev/c. (B.G.D.)

**44249** BARYON RESONANCES AS MESON-BARYON BOUND STATES WITH EMPIRICAL SELECTION RULES. George, D. J. (Stanford Univ., Calif.). Phys. Rev. Lett., 17: 595-6(Sept. 12, 1966).

A scheme is presented for combining strange or nonstrange mesons with nucleons to produce nucleon isobars with the correct masses and quantum numbers. (B.G.D.)

**44250** $K_2^0p$ INTERACTIONS AT LOW MOMENTUM. Kadyk, John A.; Oren, Yona; Goldhaber, Gerson; Goldhaber, Sulamith; Trilling, George H. (Univ. of California, Berkeley). Phys. Rev. Lett., 17: 599-603(Sept. 12, 1966). (UCRL-16912).

An analysis is given of about 1200 $K_2^0p$ interactions of the types $\Lambda^0\pi^+$, $\Sigma^0\pi^+$, and $K_1^0p$ at a mean $K_2^0$ momentum of 300 Mev/c. The relation between these reactions and the scattering lengths from $K^+$ and $K^-$ experiments is discussed, and a substantial P wave is reported in the $\Lambda^0\pi^+$ reaction. (auth)

**44251** EXPERIMENTAL TEST OF TIME-REVERSAL INVARIANCE IN $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$. Glasser, R. G. (Univ. of Maryland, College Park); Kehoe, B.; Engelmann, P.; Schneider, H.; Kirsch, L. E. Phys. Rev. Lett., 17: 603-5(Sept. 12, 1966). (TID-22856).

A study is presented on the polarization of $\Lambda^0$ in the decay of unpolarized $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$ as a test of time-reversal invariance. (B.G.D.)

**44252** TEST OF TIME-REVERSAL INVARIANCE IN $K_L^0 \rightarrow \pi^- + \mu^+ + \nu$. Abrams, R. J.; Abashian, A.; Mischke, R. E.; Nefkens, B. M. K.; Smith, J. H.; Thatcher, R. C.; Verhey, L. J.; Wattenberg, A. (Univ. of Illinois, Urbana). Phys. Rev. Lett., 17: 606-8(Sept. 12, 1966).

The polarization of the muon was measured in the decay $K_L^0 \rightarrow \pi^- + \mu^+ + \nu$ using spark chambers. On the basis of 1458 events, the component of polarization transverse to the decay plane was found to be $-0.05 \pm 0.18$, which is consistent with zero, in agreement with time-reversal invariance. (auth)

**44253** SMALL-ANGLE ELECTRON-PROTON ELASTIC-SCATTERING CROSS SECTIONS FOR SQUARED MOMENTUM TRANSFERS BETWEEN 10 AND 105 $F^{-2}$. Bartel, W.; Dudelzak, B.; Krehbiel, H.; McElroy, J. M.; Meyer-Berkhout, U.; Morrison, R. J.; Nguyen-Ngoc, H.; Schmidt, W.; Weber, G. (Deutsches Elektronen Synchrotron, Hamburg. Univ., Hamburg). Phys. Rev. Lett., 17: 608-11(Sept. 12, 1966).

Results are reported of an electron-proton scattering experiment in which the elastic scattering cross section for squared momentum transfers between 10 and 105 $F^{-2}$ was measured with a precision of about 5%. (B.G.D.)

**44254** NONRELATIVISTIC QUARK MODEL. Schiff, L. I. (Stanford Univ., Calif.). Phys. Rev. Lett., 17: 612-13(Sept. 12, 1966).

A phenomenological model is proposed for a selection principle that restricts the baryon number to integer values in order to explain why quarks are not easily knocked out of nucleons and observed by themselves. (B.G.D.)

**44255** EXTRAPOLATION OF THE AMPLITUDES OF NONLEPTONIC DECAYS OF K MESONS. Fujii, Yasunori (Stanford Univ., Calif.). Phys. Rev. Lett., 17: 613-16 (Sept. 12, 1966).

A simple extrapolation formula is derived for amplitudes of the decay $K^+ \rightarrow \pi^+ + 2\gamma$ with two photons having the total energy different from the $\pi^0$ mass. (B.G.D.)

**44256** PION SCATTERING LENGTHS. Weinberg, Steven (Univ. of California, Berkeley). Phys. Rev. Lett., 17: 616-21(Sept. 12, 1966).

The current commutation relations and partially conserved axial-vector current (PCAC) assumption allow the calculation of the matrix elements for emission and absorption of any number of soft pions and, therefore, in particular, determine the scattering length of a pion on any target particle. A simple formula for pion scattering on any particle but a pion is presented and the result is extended to the more difficult case of pion-pion scattering. (auth)

**44257** FORM FACTORS AT LARGE MOMENTUM TRANSFER. Jaffe, Arthur M. (State Univ. of New York, Stony Brook). Phys. Rev. Lett., 17: 661-3(Sept. 19, 1966).

It is pointed out that the lower bound for the form factors for the momentum transfer for nucleons can be derived from the basic principles of local quantum field theory. This bound is valid even in those cases for which the form factor was not shown to be analytic in the whole cut momentum plane. Also the result only depends on a growth condition which can be proved in local quantum field theory. The basic idea is that locality can be used to give a high energy bound on the growth of fields. (J.F.P.)

**44258** CLASSIFICATION OF THE $Y_1^*(1765)$ AND $Y_0^*(1520)$ RESONANCES IN THE 1134 REPRESENTATION OF SU(6). Coyne, J. J. (National Bureau of Standards, Washington, D. C.); Meshkov, S.; Yodh, G. B. Phys. Rev. Lett., 17: 666-8(Sept. 19, 1966).

The $Y_1^*(1765)$ $5/2^-$ resonance exhibits ratios of meson-baryon $(\underline{8} \times \underline{8})$ decay widths to meson-baryon resonance $(\underline{8} \times \underline{10})$ decay widths such as to indicate that it can be classified in the 1134 product representation of SU(6). A comparison of the decay modes of the $Y_0^*(1520)$ with those of the $Y_1^*(1765)$ shows that it, too, may be classified in the 1134. (auth)

**44259** EXPERIMENTAL INVESTIGATION OF CP VIOLATION IN $K_{e3}^0$ DECAYS. Verhey, L. J.; Nefkens, B. M. K.; Abashian, A.; Abrams, R. J.; Carpenter, D. W.; Mischke, R. E.; Smith, J. H.; Thatcher, R. C.; Wattenberg, A. (Univ. of Illinois, Urbana). Phys. Rev. Lett., 17: 669-71(Sept. 19, 1966).

A spark-chamber experiment was performed which measures the ratio $R = (K_L^0 \rightarrow \pi^+ + e^- + \overline{\nu})/(K_L^0 \rightarrow \pi^- + e^+ + \overline{\nu})$. On the basis of 1539 identified $K_{e3}^0$ decays, no variation of R is found over the Dalitz plot. The corrected integrated value is $R = 0.93 \pm 0.05$. (auth)

**44260** BOUNDS ON THE RATIO $f_-/f_+$ IN $K_{l3}$ DECAYS. Das, T. (Univ. of Pennsylvania, Philadelphia). Phys. Rev. Lett., 17: 671-4(Sept. 19, 1966).

Bounds on $f_-/f_+$ in $K_{l3}$ decays are obtained under some general assumptions on the behavior of the divergence of the strangeness-changing vector current and the amplitude for s-wave $K\pi$ scattering, and its experimental implications are discussed. (auth)

**44261** QUARKS AND MAGNETIC POLES. **Schiff, L. I. (Stanford Univ., Calif.). Phys. Rev. Lett., 17: 714-16(Sept. 26, 1966).**

It is argued that if the Dirac magnetic monopole has a finite size R, the consequent quantization of charge applies only to the total charge of all particles within a distance R of each other. Then if quarks carry third-integral charge and R is of order of a classical hadron radius, quarks can move freely within hadrons but cannot escape as individuals. (auth)

**44262** EVIDENCE AGAINST THE EXISTENCE OF A STRANGENESS +2 MESON RESONANCE AT A MASS OF 1280 Mev. **Joldersma, T.; Palmer, R. B.; Samios, N. P. (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Lett., 17: 716-19(Sept. 26, 1966).**

In order to determine the existence of nonexistence of an I = 1, Y = 2 resonance such as the $K^+K^+$, which has special relevance with respect to composite quark models as to whether the known bosons are in reality composed of two quarks with increasing angular momentum, meson $(K^+)$-proton interactions are studied. Results are reported, and a world compilation concerning this question is presented. For the reactions studied cross sections for three- and four-body final states, a Dalitz plot, and effective mass plots are given. (J.F.P.)

**44263** $\bar{p}p$ ELASTIC SCATTERING FOR INCIDENT MOMENTA BETWEEN 1.0 AND 2.50 Bev/c. Barish, B. (California Inst. of Tech., Pasadena); Fong, D.; Gomez, R.; Hartill, D.; Pine, J.; Tollestrup, A. V.; Maschke, A.; Zipf, T. F. Phys. Rev. Lett., 17: 720-2(Sept. 26, 1966). (CALT-68-91)

A measurement of $\bar{p}p$ elastic scattering for $30° \leq \theta \leq 90°$ and for incident momenta between 1.0 and 2.50 Bev/c is reported. The data show a diffraction peak in the forward direction and a pronounced minimum in the cross section in the neighborhood of $t = 0.4$ $(\mathrm{Bev/c})^2$ followed by a secondary maximum. It is suggested that this effect arises in the same manner as the minimum seen in pion-nucleon scattering and charge-exchange at a similar value of the momentum transfer. (J.F.P.)

**44264** REGGE TRAJECTORIES AND MINIMA IN DIFFERENTIAL CROSS SECTIONS. **Frautschi, Steven (California Inst. of Tech., Pasadena). Phys. Rev. Lett., 17: 722-5(Sept. 26, 1966). (CALT-68-88).**

It is emphasized that minima in $d\sigma/dt$ near $t = -0.6$ $(\mathrm{Bev})^2$ associated with passage of exchanged spins through zero may be very common, that study of this easily recognized qualitative feature may become a major aid in unravelling the details of Regge trajectories even in cases where several trajectories contribute, and that in particular the minimum of $d\sigma\ (p + \bar{p} \rightarrow p + \bar{p})/dt$ may have this origin. The situation is reviewed for $\pi^- + p \rightarrow \pi^0 + n$, $\pi^\pm + p \rightarrow \pi^\pm + p$, and $p + \bar{p} \rightarrow p + \bar{p}$. (J.F.P.)

**44265** EVIDENCE FOR A K*(1320) RESONANCE. **Shen, Benjamin C.; Butterworth, Ian; Fu, Chumin; Goldhaber, Gerson; Goldhaber, Sulamith; Trilling, George H. (Univ. of California, Berkeley). Phys. Rev. Lett., 17: 726-30(Sept. 26, 1966).**

It is suggested that the broad $K^*(890)\pi$ enhancement from 1.15 to 1.55 Bev is a complex phenomenon consisting of at least three parts: kinematic enhancement via the Deck mechanism, a possible new K* resonance at 1320 Mev, and an alternative decay mode of the K*(1430). It is further speculated that the $A_1$ and K*(1320) could be members of an octet. (auth)

**44266** ALGEBRA OF CURRENTS AND THE $K_1^0$-$K_2^0$ MASS DIFFERENCE. **Riazuddin (Univ. of Pennsylvania, Philadelphia); Mathur, V. S.; Pandit, L. K. Phys. Rev. Lett., 17: 736-9(Sept. 26, 1966).**

The $K_1^0$-$K_2^0$ mass difference is calculated exactly from some recently suggested nonleptonic decay models by use of the techniques of the algebra of currents. $M(K_2^0 - M(K_1^0) = 0.49/\tau(K_1^0)$ is found which agrees in both sign and magnitude with the recent experiments. (auth)

**44267** HIGH ENERGY ELASTIC SCATTERING AND A PERIPHERAL AND UNCORRELATED JET MODEL. **Hama, Mitsuru (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), 36: 59-71(July 1966).**

High-energy elastic scattering above a few tens of Bev/c at finite angles is investigated as the shadow scattering of multiple production, for which a phenomenological, peripheral and uncorrelated jet model is used by taking into account energy-momentum conservation. The elastic amplitudes can be related to the production amplitudes of the emitted particles in multiple production in a rather simple form. It is shown qualitatively that the proton-proton differential cross section near a cms angle of 90° is almost flat. Also the difference between the $\pi$-N forward and backward peaks, and the difference between the $\pi^+$-p and $\pi^-$-p backward elastic scattering are obtained. Rough quantitative estimates are performed by an appropriate choice of the production amplitude which seems to be consistent with the data on jets. (auth)

**44268** A NEW DERIVATION OF CLASSICAL MODELS OF THE SPINNING ELECTRON FROM THE WKB SOLUTIONS TO THE PAULI AND DIRAC EQUATIONS. **Yamasaki, Hisaiti (Kyusyu Dental College, Kitakyusyu, Japan). Progr. Theoret. Phys. (Kyoto), 36: 72-85(July 1966).**

The functional form of the wave function with respect to variables appropriate for the WKB approximation is chosen by taking into account the transformation properties of the spinor wave function. This representation makes it possible, using only the wave equation, to pursue directly the time changes in the variables, i.e., the spin direction, velocity and density, etc., characterizing an electron. These changes correspond straightforwardly to a classical model of the nonrelativistic Pauli electron with the proper magnetic moment, and the covariant form of this model, which is just "the Frenkel-Kramers model of the Dirac electron." In this derivation, the existence of freedom of rotation around the spin axis and certain definite angular velocity of this rotation are required. These results and the correspondence obtained may clarify the classical-mechanical significance of the spinor wave function and also of the spin itself. An explanation of the hyperbolic functions of the velocity metric, which help in the complicated calculations for the Dirac electron, is also given. (auth)

**44269** ELECTROMAGNETIC STRUCTURE OF THE NUCLEON WITH MANY-PARTICLE STRUCTURE. **Kinoshita, Yukiko (Rikkyo Univ., Tokyo); Kobayashi, Tsunehiro; Machida, Shigeru; Namiki, Mikio Progr. Theoret. Phys. (Kyoto), 36: 107-30(July 1966).**

The electric and magnetic form factors of nucleons are treated on the basis of the model in which the nucleon has a "central part" with spin one half, which is composed of three urbaryons (like quarks) and whose extent is of the order of magnitude of the nucleon Compton wave length. These quarks need not have a "particle-nature" in all respects, but may be some sort of quasi-particles. (auth)

**44270** K-π RESONANCES AND THE μ POLARIZATION IN $K_{\mu 3}$. Ito, Yukio (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto), 36: 182-4(July 1966).

The relation between the K-π resonances and the form factors is discussed. A quantity is found which can be measured in order to detect the spin of the meson (κ) under the assumption $I = \frac{1}{2}$. The quantity found is the $\mu^+$ polarization parallel to the μ, π, and ν directions for the resonances considered. This $\mu^+$ polarization parallel to the ν direction is shown as a function of the π-ν angle in the $K^+$ rest frame. The measurement of this quantity is useful in deciding the spin of κ and the role of resonances in the form factors in the $K_{l3}$ decay. (J.F.P.)

**44271** TWO-PION-EXCHANGE POTENTIAL WITH NUCLEON PAIRS. Hiroshige, Noboru; Senba, Kei (Hiroshima Univ.). Progr. Theoret. Phys. (Kyoto), 36: 184-5(July 1966).

As a possibility of explaining the discrepancy between the results of Furuichi and Watari and of Hoshizaki and Machida, it is considered that a strong L-S coupling in the two-meson (π) contribution to the low-energy nucleon-nucleon scattering may be due to the contribution from the one-pair term and two-pair term which was neglected in the analysis of Hoshizaki and Machida. The two-meson (π) exchange potential is calculated assuming ps(ps) coupling for the case where energy conservation holds. It is found that the two-meson (π) exchange potential gives a strong L-S potential when the negative energy states of virtual nucleons are taken into consideration and that the ratio of the no-pair term to the one-pair term or two-pair term in the L-S potential is larger than that in the central potential. (J.F.P.)

**44272** POLARIZATION EFFECTS IN THE DISINTEGRATION OF $\mu^-$ MESONS. Gabos, Zoltan; Uliu, Florea. Stud. Cercet. Fiz., 18: 635-41(1966). (In Rumanian).

Continuing studies on the polarization of electrons formed during the disintegration of $\mu^-$ mesons with oriented spin, formulas were derived for determining the degree of longitudinal and transversal polarization, with validity for the whole range of the energy spectrum. The equation obtained was found to be valid for the case of summation with respect to the direction of emission of neutrinos and antineutrinos. The disintegration $\mu^- \rightarrow e^- + \nu + \bar{\nu}$ was examined, determining the disintegration amplitude on the basis of the bispinor of the electrons, mesons, neutrinos and antineutrinos. The Stokes parameters of the analyzer were introduced into the calculation, deriving an equation which indicated the response of the measuring instrument with respect to the action of an electron with a polarization state indicated by the density matrix. (TTT)

**44273** VAVILOV-CHERENKOV RADIATION IN A MEDIUM WITH TWO CYLINDRICAL BOUNDARIES. Semenova, T. A. Vestn. Moskov. Univ., Ser. III: Fiz. Astron., No. 3, 27-35(May-June 1965). (In Russian).

The dispersion equation and the expressions for the energy loss of electrons, propagated in channels in cylindrical dielectric rods, were derived. The eigenfrequencies of the emitter, having a large dielectric permeability and given geometric dimensions, and the distribution of the radiation output were found. The tables of eigenfrequencies made it possible to determine the degree of proximity of the system to resonance. The radiator with nonresonant properties can be used for measurement of large ε. (tr-auth)

**44274** ON THE THEORY OF β-DECAY IN THE EXTERNAL MAGNETIC FIELD. Ternov, I. M.; Lysov, V. A.; Korovina, L. I. Vestn. Moskov. Univ., Ser. III: Fiz. Astron., No. 5, 58-63(Sept.-Oct. 1965). (In Russian).

The effect of stable and homogeneous magnetic fields on the energy spectrum and the polarization of decay electrons from nonpolarized neutrons, occurring in this field, were investigated. The dependence of the field probability of the decay on the magnitude of the magnetic field was evaluated. (tr-auth)

**44275** DIFFERENTIAL CROSSING OF INELASTIC INTERACTION OF NUCLEON WITH DEUTERON. Komarov, V. V.; Muskalu, Shtefan; Popova, A. M. Vestn. Moskov. Univ., Ser. III, Fiz. Astron., No. 1, 50-8(Jan.-Feb. 1966). (In Russian).

Simple formulas for differential cross sections of inelastic nucleon-deuteron interactions were developed on the basis of precise integral equations for the amplitude of three-nucleon interactions at low energies. (tr-auth)

**44276** DEVELOPMENT OF RESONANCE WITH SPIN $\frac{3}{2}$ IN A HIGH-ENERGY NEUTRINO BEAM. Gronskii, V. K.; Satsunkevich, I. S. Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk, No. 1, 49-53(1965). (In Russian).

An expression for the cross section of the 4-fermion interaction $\nu + N \rightarrow N^* + \mu$ is derived. All possible induced components of a weak flux of heavy particles are considered, and the cross section of the generation of polarized $N^*$ particles is estimated. (J.F.P.)

**44277** FORMATION OF THE PHOTON PAIRS OF THE POLARIZED VECTOR W-MESONS. Bolsun, A. I. Vestsi Akad. Navuk BSSR, Ser. Fiz.-Mat. Navuk, No. 1, 98-100 (1965). (In Russian).

Photon pair formation of the vector meson (W) at the threshold of formation and at the high-energy region is considered. The parallel-polarized mesons (W) in the former and the transversely polarized ones in the latter case are generated in this process. Equations for the total and differential cross sections are derived and discussed. (J.F.P.)

**44278** ABSORPTIVE CORRECTIONS TO THE REACTION $\gamma p \rightarrow N^*\pi$ IN THE ONE-PION EXCHANGE MODEL WITH GAUGE INVARIANT EXTENSION. Locher, M. P.; Sandhas, W. (Univ., Bonn). Z. Phys., 195: 461-73(1966).

Absorptive corrections were calculated for photoproduction of $N^*$. Two versions for the uncorrected production amplitude are used. First, the one-pion-exchange Born approximation in the Coulomb gauge and second, a gauge invariant extension, restricted to the orbital electromagnetic current and to the isospin I = 1-amplitude in the t-channel. The second restriction was found to be unimportant. Numerical values for cross sections and decay correlations in the Bev region are given in diagram form. Present day experimental accuracy does not allow to test the effects of absorption. (auth)

**44279** ELASTIC ed SCATTERING AND VIOLATION OF CP INVARIANCE. Dubovik, V. M.; Cheshkov, A. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz., 51: 165-8(July 1966). (In Russian).

The cross section for elastic scattering of electrons on deuterons is derived. The contribution of the T-nonvariant deuteron current form factor to the cross section is discussed; the experimental data are employed for this purpose. Polarization experiments for detection of a T-noninvariant form factor, which are based on asymmetry of the angular distribution and polarization of recoil deuterons, are considered. (auth)

**44280** QUASI-NUCLEON INTERACTIONS BETWEEN 24 Gev/c PROTONS AND NUCLEI OF A PHOTOGRAPHIC EMULSION IN A STRONG MAGNETIC FIELD. Galstyan, D. A.; Zhdanov, G. B.; Tretyakova, M. I.; Shcherbakova, M. N.; Chernyavskii, M. M. (Inst. of Physics, Academy of Sciences, USSR). Zh. Eksp. Teor. Fiz., 51: 417-27 (Aug. 1966). (In Russian).

Quasi-nucleon interactions of 24 Bev/c protons are studied by the photographic emulsion technique in a pulsed 180 Oe magnetic field. Besides complete information relating to all charged secondary particles (emission angle, momentum and nature of particle) the total energy of neutral mesons was also determined. The interactions were divided into peripheral and nonperipheral by employing various criteria. The multiplicity distributions, inelasticity coefficients and angular distributions of the particles have been determined for both types of distributions. Large fluctuations in the distribution of energy between charged and neutral mesons have been detected. An appreciable difference between the energy spectra for $\pi^+$- and $\pi^-$-mesons has been found. The results obtained indicate a large excitation probability for various nucleon isobars. (auth)

**44281** GENERAL FORM OF THE SOLUTION OF THE CHEW-LOW EQUATIONS FOR $\pi$N-SCATTERING. Meshcheryakov, V. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz., 51: 648-57(Aug. 1966). (In Russian).

General solutions of the Chew-Low equations are obtained for S, P, D, and other partial waves. The non-unique nature of the solutions is established. It is shown that the strong dependence of the $\pi$N-scattering S-phases on the magnitude of the total isotopic spin of the $\pi$N system may be understood within the framework of unitarity and cross symmetry. (auth)

**44282** ANTIVESHCHESTVO. (Antimatter). Vlasov, N. A. Moscow, Atomizdat, 1966. 184p.

A brief review is given of the discovery of antiparticles and their properties. The formation of electron-positron pairs, of antiprotons, and their annihilation is discussed along with some cosmological problems of antiparticles and the role of antimatter in the universe. 166 references. (G.O.Y.)

# Field Theory, Scattering Theory, and Symmetries

## *See also* Elementary Particles and Radiations

*Refer also to abstracts 44707 and 44806.*

**44283** (NP-16280) NEKOTORYE SVOISTVA RESHENII URAVNENIYA SHREDINGERA DLYA POTENTSIALOV S KULONOVSKIM "KHVOSTOM". (Certain Peculiarities of Schrodinger Equation Solutions for Potentials with Coulomb "Tails"). Report No. 435. Perelomov, A. M.; Popov, V. S.; Terent'ev, I. V. (Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow. Institut Teoreticheskoi i Eksperimental'noi Fiziki). 1966. 12p. Dep. mn.

For the potentials of the type $V(z) \rightarrow 1/r$, $r \rightarrow \infty$ the asymptotic form of the wave function $\psi_{lm}(z)$ at $xz \gg 1$ was found and the character of the singularity $\rho_{lm}(\rho)$ at the point $\rho^2 = -x^2$ was determined. The connection between the coefficient $C_{xl}$ and the residue of the scattering matrix $S_l(k)$ at the pole $k = ix$ corresponding to the bound state was found. The conditions when the deviation V(z) at small r from the purely Coulomb potential does not break the level spectrum higher symmetry described by the group 0(4) were obtained. (auth)

**44284** NEW PRINCIPLES FOR QUANTIZATION OF RELATIVISTIC FIELD THEORIES. Bopp, F.; Eichenauer, B.; Genz, H.; Meyer, W. (Univ., Munich). Acta Phys. Austr., 22: 210-16(1966). (In German).

The principles for quantization of relativistic field theories are formulated and some consequences of these principles are indicated. (J.S.R.)

**44285** $SU_6$ CLEBSCH-GORDAN COEFFICIENT FOR THE PRODUCT 35 ⊗ 35. Krammer, Margarete (Univ., Graz). Acta Phys. Austr., 22: 245-50(1966). (In German).

$SU_6$ was reduced by the subgroup $SU_3 \otimes SU_2$ for the direct product 35 ⊗ 35 and the coefficients obtained are tabulated. (J.S.R.)

**44286** CENTRAL COLLISIONS OF NUCLEONS WITH HEAVY NUCLEI FOR ENERGY HIGHER THAN $10^{12}$ ev. Holynski, R.; Krzywdzinski, S.; Miesowicz, M. (Inst. of Nuclear Research, Krakow). Acta Phys. Pol., 30: 73-91 (July 1966).

220 interactions originated by singly charged or neutral particles of the energy above $10^{12}$ ev were analyzed. The analysis was performed in six groups of events defined by multiplicity $n_s$ and number of evaporation tracks $N_h$. Angular distributions of secondaries, distributions of anisotropy parameter $\sigma$, distributions of bimodality parameter D, $\sigma$-D correlation and distributions of inelasticity coefficient K were studied. For central collisions between nucleons and heavy nuclei (these collisions were selected by criteria of $N_h > 8$ and $n_s \geq 30$) a model was proposed. In the model these collisions are treated as a superposition of the elementary nucleon-nucleon collisions. (auth)

**44287** OSCILLATOR-LIKE REPRESENTATIONS OF THE U(N,N) ALGEBRAS. Olszewski, J. (Jagellonian Univ., Krakow). Acta Phys. Pol., 30: 93-104(July 1966).

A certain class of very special infinite-dimensional, unitary, irreducible representations of noncompact U(N,N) groups and their algebras, which are called "oscillator-like" representations, and which are explicitly constructed out of boson creation and annihilation operators are considered. They contain infinite "towers" of multiplets of the maximal compact subalgebra U(N) ⊗ U(N) of U(N,N), which, in the case of N = 6, leads to the "ladder representations" recently discussed by Dothan, Gell-Mann and Ne'eman, and others. The possibility of obtaining mass formulas from such representations according to the ideas of Barut is mentioned, as well as the possibility of their "boosting" (relativistic completion). (auth)

**44288** EXPLICIT CONSTRUCTION OF THE OSCILLATOR-LIKE REPRESENTATIONS OF THE U(2,2) ALGEBRA IN A SPIN BASIS. Olszewski, J. (Jagellonian Univ., Krakow). Acta Phys. Pol., 30: 105-23(July 1966).

The explicit construction of the oscillator-like representations of U(N,N) algebras (introduced in previous work) is begun in a spin basis with the simplest nontrivial case of the U(2,2) algebra. In this case the standard angular momentum algebra can be applied to reduce the $SU(2)_1$ spin subalgebra out from the maximal compact U(2) ⊗ U(2) subalgebra of U(2,2) and to take all generators (compact and noncompact) of U(2,2) as irreducible, spherical, tensors of rank 0 and 1, in the sense of Racah. The procedure of computing all their nonzero matrix elements, in a spin basis, is thus limited to their reduced matrix elements, which can be easily obtained. Also the Dirac basis of generators of SU(2,2) algebra, which is also a suitable basis for the isomorphic SO(4,2) algebra is introduced. Finally, the Casimir operators of some subgroups of SO(4,2) are calculated, and the possibility of obtaining various forms for the mass operators, and their corresponding mass formulas is discussed. (auth)

**44289** EQUAL TIME COMMUTATORS AND SCALAR MESONS DECAYS. Kwiecinski, J. (Inst. of Nuclear Research, Krakow). Acta Phys. Pol., 30: 341-4(Aug. 1966).

The equal-time commutation relations are used to estimate the decay rates of scalar mesons decaying into two pseudoscalar mesons. Taking the presented model literally it is found that the scalar mesons are rather weakly coupled to pseudoscalar mesons. This in in qualitative agreement with bootstrap-like estimates. (J.F.P.)

**44290** PROBLEM OF DYNAMICAL GROUPS IN QUANTUM MECHANICS. Szymacha, A.; Werle, J. (Univ., Warsaw. Inst. for Nuclear Research, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys., 14: 325-30 (1966).

Two questions are considered on the problem of dynamical groups in a physical system: how and to what extent can a group determine the dynamic properties of the system; and how to specify the physical system. The quantum mechanical system consisting of two nonrelativistic spinless particles in the center of mass frame is considered; the dynamical group is taken as the full orthogonal group $O_4$ in four dimensions. It is shown that the dynamical characteristics of the system follow from the existence of a suitable dynamical group and a few very weak and natural additional assumptions. (L.B.S.)

**44291** SU$_3$ AS A DYNAMICAL GROUP OF THE HAMILTONIAN $H = \frac{1}{2} p^2 + V(r)$. Szymacha, A. (Univ., Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys., 14: 331-5(1966).

The problem of deducing all important dynamical properties of a quantum mechanical system from the postulated dynamical group is considered for the SU$_3$ group. It is proved that the only possible potential has the form $V = \frac{1}{2} ar^2$. It is shown that the postulated SU$_3$ symmetry of the hamiltonian implied indeed the oscillator potential, the correct energy spectrum and degeneracy of the levels. (L.B.S.)

**44292** CANONICAL FORMALISM FOR DOUBLE POLE. Lukierski, J. (Univ., Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys., 14: 337-43(1966).

The generalization of Schwinger's quantization methods developed for higher order lagrangians is used to establish the lagrangian formulation of the theory of relativistic double pole. (C.E.S.)

**44293** GENERALIZATION OF LEVINSON'S THEOREM. Sekine, Katsuhiko (Institut Henri Poincare, Paris). Cah. Phys., 20: 41-54(Feb. 1966). (In French).

Levinson's theorem is generalized in such a way as to explain also the case of the difference of the threshold values and the infinite energy of dephasing is not an integral multiple of $\pi$. The restriction which is usually imposed on the asymptotic behavior of the scattering amplitude is lifted. A nonrelativistic model is examined using the N/D method. The residue, $a_{-1}$, at the point of infinity of the derivative of the function D, comes into play in the new formula. In the particular case when this residue is a positive integer, this number is interpreted as the number of Castillejo, Dalitz, Dyson (CDD) poles at the point of infinity and then the formula is reduced to that proposed by Warnock. The ambiguity of Castillejo et al., is eliminated by introducing the notion of the number of CDD poles in the complex extended plane. (tr-auth)

**44294** A NEW METHOD FOR CALCULATION OF FEYNMAN DIAGRAMS. Kessler, Paul (College de France, Paris). Cah. Phys., 20: 55-70(Feb. 1966). (In French).

A new method for Feynman diagram calculation, based upon factorization into vertex amplitudes, and the use of conservation laws at every individual vertex is presented. This method allows the instantaneous (traceless) calculation of large classes of Feynman diagrams. With the help of an ad hoc space-time formalism which is introduced, diagrams with time-like and space-like virtual particles are treated simultaneously. The formulas which allow the calculation of second order diagrams with exchange of a photon (or $\rho$, $\omega$, $\varphi$, K*), of a vector boson with both parities, of a fermion, and of any particle (in a pure spin and parity state) having its spin between 0 and $\frac{5}{2}$ are successively established. Extension to higher order diagrams should not lead to any major difficulty. The main problem which remains to be solved is the inclusion of interference terms into the treatment, in order to achieve an exact, instantaneous and universal method for Feynman diagram calculation. (auth)

**44295** MASSIVE SPIN-TWO FIELD. Deser, S.; Trubatch, J.; Trubatch, S. (Brandeis Univ., Waltham, Mass.). Can. J. Phys., 44: 1715-18(Aug. 1966).

The energy of the free massive spin-two field is exhibited as a manifestly positive-definite function of its canonical variables. The indefiniteness of the form recently obtained by Adler is shown to be only apparent in nature. A summary of the canonical reduction of the theory is given. (auth)

**44296** BREAKING THE [SYMMETRY] LAW. CERN Cour., 6: 171-4(Sept. 1966).

The experiments on the decay of the meson ($\eta$) into three mesons ($\pi$) and the decay of the long-lived neutral meson (K) showing symmetry violation are reviewed. The discussion includes a review of CPT symmetry, the strong, electromagnetic, and weak forces, and a historical review of symmetry breaking theory. Other topics are a review of the CERN meson ($\eta$) decay experiment and a summary of the present status of CPT. (J.F.P.)

**44297** CANONICAL QUANTIZATION. Streater, R. F. (Massachusetts Inst. of Tech., Cambridge). Commun. Math. Phys., 2: 354-74(1966).

The dynamical variables of a classical system form a Lie algebra $\mathfrak{G}$, where the Lie multiplication is given by the Poisson bracket. Following the ideas of Souriau and Segal, but with some modifications, it is shown that it is possible to realize $\mathfrak{G}$ as a concrete algebra of smooth transformations of the functionals $\Phi$ on the manifold $\mathfrak{M}$ of smooth solutions to the classical equations of motion. It is even possible to do this in such a way that the action of a chosen dynamical variable, say the hamiltonian, is given by the classical motion on the manifold, so that the quantum and classical motions coincide. In this realization, constant functionals are realized by multiples of the identity operator. For a finite number of degrees of freedom, n, the space of functionals can be made into a Hilbert space $\mathcal{H}$ using the invariant Liouville volume element; the dynamical variables F become operators $\hat{F}$ in this space. It is proven that for any hamiltonian H quadratic in the canonical variables $q_1 \ldots q_n, p_1 \ldots p_n$ there exists a subspace $\mathcal{H}_1 \subset \mathcal{H}$ which is invariant under the action of $\hat{p}_j$, $\hat{q}_k$ and H, and such that the restriction of $\hat{p}_j$, $\hat{q}_k$ to $\mathcal{H}_1$ form an irreducible set of operators. Therefore, Souriau's quantization rule agrees with the usual one for quadratic hamiltonians. In fact, it gives the Bargmann-Segal holomorphic function realization. For nonlinear problems in general, however, the operators $\hat{p}_j$, $\hat{q}_k$ form a reducible set of any subspace of $\mathcal{H}$ invariant under the action of the hamiltonian. In particular this happens for $H = \frac{1}{2} p^2 + \lambda q^4$. Therefore, Souriau's rule cannot agree with the usual quantization procedure for general non-linear systems. (auth)

**44298** APPLICATION OF SPECTRAL REPRESENTATIONS TO THE NONRELATIVISTIC AND THE RELATIVISTIC BETHE-SALPETER EQUATION. Kramer, G. (Physikalisches Staatsinstitut, Hamburg); Meetz, K. Commun. Math. Phys., 3: 29-52(Aug. 11, 1966).

The eigenvalue problem of the scalar Bethe-Salpeter equation is solved by application of the vertical Dyson representation. The method of solution is developed in complete analogy to the solution of Schroedinger's equation by a Stieltjes representation in the case of a Yukawa potential. The eigenvalues are zeros of a characteristic determinant, which can be understood as a generalization of the nonrelativistic Jost function. (auth)

**44299** NEW EMPIRICAL RELATIONS BETWEEN BARYONIC MASSES. Zaikov, R. Compt. Rend. Acad. Bulg. Sci., 19: 357-9(1966).

Some relations between baryonic masses, which were previously established using the Flato-Sternheimer mass formula and the tables on particles and resonant states of Rosenfeld et al., are revised using new data on baryonic masses. These relations permit the masses of unobserved baryons entering the SU(3) multiplets to be predicted. (J.F.P.)

**44300** PRINCIPLE OF MAXIMUM AND MINIMUM IN POTENTIAL THEORY. ATTEMPT AT A GENERAL THEORY. Mokobodzki, Gabriel; Sibony, Daniel (Institut Henri Poincare, Paris). Compt. Rend., Ser. A, 263: 126-9(July 18, 1966). (In French).

A sufficiently general theory of harmonic functions is derived, based on a convex cone S of numerical functions bounded by the locally compact space $\Omega$, in such a way, that the elements of S are superharmonic functions delimited by the theory. (G.O.Y.)

**44301** BEHAVIOR OF THE SOLID PART OF THE FORWARD SCATTERING AMPLITUDE AND TOTAL CROSS SECTIONS AT HIGH ENERGIES. Arushanov,

G. G. (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Dokl. Akad. Nauk Uz. SSR, No. 5, 20-2(1966). (In Russian).

Equations for the real part of forward scattering amplitude and the total cross sections at high energy were developed considering that diffraction takes place at high energies, i.e., that with the increased energy the ratio $\underline{\delta}$ of the real part of the amplitude of forward scattering to the imaginary part and the cross section of the backward scattering converge to zero. (R.V.J.)

**44302** REMARKS ON THE PHYSICAL INTERPRETATION OF SU(6,6) THEORY. **Sheldon, E.; Baltes, H. P.** (Eidgenoessische Technische Hochschule, Zurich). Helv. Phys. Acta, 39: 404-19(Aug. 15, 1966). (In German).

The subalgebras A(SU(6)), A(SU(3)), and A(SU(2,2)) were identified on the basis of a matrix representation of the group algebra A(SU(6,6)). From the subalgebra $A(L\updownarrow\otimes SU(3))$ a maximum set of commutating physical observables can be obtained, whose simultaneous eigenstates (quarks) yield the 12 representation of the SU(6,6). The 4 representation of the SU(2,2) is realized as the bispinor representation of the proper Lorentz group $L\updownarrow \subset SU(2,2)$. These conditions establish that the transition of 12 to an equivalent representation is to be interpreted as an inversion of the physical frame of reference, and further that the SU(6,6) quarks are to be subjected to an SU(3)-extended Dirac equation. From there the physical-inspired requirement concerning the positive energy eigenvalues leads to the (expanded) Bargmann-Wigner equations, whose solutions are discussed. For the representations 12, 143, and 364 analogous equations and their solutions and also the subgroup structure in reference to $L\updownarrow$ are given. Thus the SU(6,6) theory leads completely from the A(SU(6,6)) matrix formalism and the Bargmann-Wigner equations introduced by Salam, Delbourgo and Strathdee can be established group theoretically. It is shown that the space reflection, the time reversal and the particle conjugation also adapt freely to this framework. (tr-auth)

**44303** ON TWO GAUGE CLASSES AND THE INVARIANCE OF THE S MATRIX IN QUANTUM ELECTRODYNAMICS. **Zulauf, M.** (Univ. of Bern). Helv. Phys. Acta, 39: 439-50(Aug. 15, 1966).

Starting with radiation- and Feynman-gauge and introducing operator gradient transformations, two classes of gauges are distinguished. The operators of the two classes are not related by gradient transformations. The propagators for both classes are given. Invariance of the S-matrix and a transformation from one class to the other is proved and it is shown that for internal lines none of the four components of the electromagnetic potential vanish for any gauge. (auth)

**44304** REPRESENTATION OF GROUP GENERATORS BY BOSON OR FERMION OPERATORS APPLICATION TO SPIN PERTURBATION THEORY. **Enz, Charles P.** (Univ. of Geneva). Helv. Phys. Acta, 39: 463-5(Aug. 15, 1966).

It is remarked that representations of spin by fermion operators have a much larger generality valid for bosons as well as fermions. The elements of perturbation theory are also discussed in the representation of spin by fermion operators. (J.F.P.)

**44305** NORMAL THRESHOLDS IN SUBENERGY VARIABLES. **Landshoff, P. V.; Olive, D. I.; Polkinghorne, J. C.** (Cambridge Univ., Eng.). J. Math. Phys., 7: 1593-9(Sept. 1966).

The discontinuity across the normal threshold in a subenergy variable is evaluated by S-matrix methods. The effect on the discontinuity of continuing past higher Landau singularities is discussed. (auth)

**44306** THE ICECREAM-CONE SINGULARITY IN S-MATRIX THEORY. **Landshoff, P. V.; Olive, D. I.; Polkinghorne, J. C.** (Cambridge Univ., Eng.). J. Math. Phys., 7: 1600-6(Sept. 1966).

The ice cream-cone singularity is analyzed by S-matrix theory methods. It is found to appear only in that part of the physical region predicted by finite-order perturbation theory. The corresponding discontinuity is derived, and the nature of the singularity is discussed. (auth)

**44307** EXISTENCE OF SOLUTIONS OF N/D EQUATIONS. **Atkinson, D.** (Univ. of California, Berkeley). J. Math. Phys., 7: 1607-12(Sept. 1966).

The manifold of solutions of certain classes of N/D equations is considered, under the restriction that the scattering amplitude have a uniform bound in all complex directions. Two cases are treated: (i) The N integral equation is Fredholm, but the associated homogeneous equation may have solutions; (ii) the equation has the marginally singular behavior characteristic of an asymptotically constant left-hand cut discontinuity. The existence theorem in the latter case proceeds by the construction of the appropriate resolvent. (auth)

**44308** ON QUANTIZATION IN SPACE WITH TORSION. **Finkelstein, R.** (Univ. of California, Los Angeles). J. Math. Phys., 7: 1632-42(Sept. 1966).

Some elementary quantization questions are discussed under the hypothesis that physical space is a homogeneous space of constant torsion. In such a space, a freely propagating point particle appears to have extension in the sense that it obeys the Schrödinger equation of a symmetric top. Modifications of commutators and scattering amplitudes are given. The geometrical methods are based on the correspondence with the associated group-space. (auth)

**44309** LOCAL STATES. **Licht, A. L.** (Naval Ordnance Lab., Silver Spring, Md. Univ. of Maryland, College Park). J. Math. Phys., 7: 1656-69(Sept. 1966).

A heuristic discussion is given of the preparation of states in finite space-time regions. Some axioms concerning such states are derived from this discussion. It is shown that states requiring for their preparation a selection of events according to the outcome of a measurement will not be "strictly local." Nonselective states will, however, be "strictly local." The mathematical structure of such states is investigated. (auth)

**44310** ABSORPTIVE PARTS AND THE BETHE-SALPETER EQUATION FOR FORWARD SCATTERING. **Nussinov, S.; Rosner, J.** (Univ. of Washington, Seattle). J. Math. Phys., 7: 1670-9(Sept. 1966). (TID-22680).

A Laplace transform approach to the Bethe-Salpeter equation was developed for absorptive parts of forward scattering amplitudes. The method appears direct and unsophisticated and is useful for computation. It is essentially identical to decomposition into four-dimensional partial waves, but the inversion formula is more straightforward. The high-energy behavior of sums of several types of $\phi^4$ graphs in the weak- and strong-coupling limits was obtained. These examples illustrate some general results we obtain for Mth order $\phi^4$ kernels. Specifically, the absorptive part behaves as $s^{n_0}(\log s)^\beta$ for high s; for weak coupling $\lambda$, $n_0 \sim \lambda^{\frac{1}{2}M}$, while for strong coupling in the ladder graph approximation, $n_0/\lambda^{\frac{1}{2}} \rightarrow \frac{1}{2}\pi$. An interesting inequality related to absorptive parts was also proved. One of its corollaries is that uncrossed ladder graphs "majorize" crossed ones. (auth)

**44311** ORDERING THEOREMS. **Rohrlich, F.; Wray, J. G.** (Syracuse Univ., N. Y.). J. Math. Phys., 7: 1697-1706(Sept. 1966).

Various theorems related especially to time-ordered products are proven. Applications to quantum field theory include particularly simple derivations of the off-mass-shell extensions of the S-operator and of the interpolating field. The latter are a generalization of the results of Glaser, Lehmann, and Zimmermann. (auth)

**44312** ALGEBRAIC ASPECTS OF TRILINEAR COMMUTATION RELATIONS. **Scharfstein, H.** J. Math. Phys., 7: 1707-19(Sept. 1966).

An attempt is made to derive from the formalism of Schwinger's action principle, in a more convincing manner than previously described, a set of trilinear equal-time commutation relations which contains the commutation relations first discussed by H. S. Green as special cases. Matrix representations of field operators satisfying the trilinear commutation relations are considered. Two representations are explicitly discussed: a four-dimensional and an eight-dimensional representation. The representations considered and the bilinear equal-time commutation relations between the associated "component fields" obeying ordinary statistics are specified by irreducible representations of an algebra which is suggested by the trilinear commutation relations. The component fields associated with the same representation and of the same spin differ from each other in their bilinear equal-time commutation relations with other fields. This difference is reflected in the interactions into which the various fields can enter. (auth)

**44313** ON THE EXISTENCE OF FIELD THEORY. I. THE ANALYTIC APPROACH. **Taylor, J. G. (Rutgers-The State Univ. of New Jersey, New Brunswick). J. Math. Phys., 7: 1720-9(Sept. 1966).**

The problem of existence of solutions to local field equations is studied. The field equations are set up so that the solutions correspond to fixed points of a mapping of the space of Green's functions into themselves. An attempt is made to use analytic methods to determine these fixed points, in particular, the contraction mapping principle. To do this a rotation to Euclidean space from Lorentz space is performed; in Euclidean space the existence of solutions to a large class of approximating equations to the field equations, obtained by requiring the Green's functions to be zero if they have more than a certain number of external particles, is proved. By this method it is proved that there is only the trivial zero solution to certain types of bootstrap equations. The contraction mapping theorem does not appear powerful enough to discuss the complete field equations. (auth)

**44314** STRUCTURE OF 4-SPINORS. **Teitler, S. (Naval Research Lab., Washington, D. C.). J. Math. Phys., 7: 1730-8(Sept. 1966).**

The possible underlying spinor spaces used in the description of Dirac 4-spinors are enumerated and classified within the framework of vector Clifford algebra. The relation with the usual matrix formulation is reviewed. Proper Lorentz transformation, space, and time inversions are described in the Clifford algebra formalism. A representation-independent definition of charge sign conjugation is given. (auth)

**44315** LORENTZ EQUIVALENCE, UNITARY SYMMETRY, AND SPIN UNITARY SYMMETRY. **Teitler, S. (Naval Research Lab., Washington, D. C.). J. Math. Phys., 7: 1739-42(Sept. 1966).**

The enumeration and classification of the minimal ideals (spinor spaces) of the vector Clifford algebra generated from the vector basis of Lorentz space-time obtained previously is used in a discussion of equivalence mappings among these minimal ideals. Lorentz equivalence is defined as an equivalence mapping which possesses Lorentz symmetry. The concept of regular decomposition is introduced by which any element of the complete algebra is expressed in terms of a complete set of minimal ideals or spinor spaces. A regular current density which is invariant under unitary symmetry $U_4$ among the spinor spaces of the regular decomposition is defined. The spin unitary symmetry, within a spinor space under which the spinor current density is invariant, is discussed. (auth)

**44316** TWO-MESON SOLUTION OF THE CHARGED SCALAR STATIC MODEL. **Bronzan, J. B. (Massachusetts Inst. of Tech., Cambridge). Contract AT(30-1)-2098. J. Math. Phys. (N. Y.), 7: 1351-61(Aug. 1966). (MIT-2098-219).**

A solution is presented of the charged scalar static model, in which the scattering amplitude is crossing symmetric and has two- and three-particle intermediate states (two-meson approximation). The production and six-point amplitudes are also obtained and are shown to lead to a two- and three-particle unitary scattering matrix. (auth)

**44317** ROLE OF CAUSALITY IN QUANTUM FIELD THEORY AND THE DYNAMICAL POSTULATE. **Chen, T. W.; Rohrlich, F.; Wilner, M. (Syracuse Univ., N. Y.). J. Math. Phys. (N. Y.), 7: 1365-71(Aug. 1966).**

It is shown that Bogoliubov causality together with the usual assumptions of quantum field theory suffice to determine the off-mass-shell behavior of the S-operator as that resulting from the $\varphi$-product. The same assumptions lead to an equation for the current which replaces the field equation for the interpolating field. The specification of the interaction term in this equation correspond to the specification of an interaction hamiltonian in the usual formalism. This interaction term is an operator distribution whose support is a single point and which is otherwise severely restricted. (auth)

**44318** WAVE-PACKET DERIVATION OF FIELD-THEORETIC SCATTERING AMPLITUDE. **Frantz, Lee M. (TRW Systems, Redondo Beach, Calif.). J. Math. Phys. (N. Y.), 7: 1421-35(Aug. 1966).**

A formal expression is derived for the field-theoretic scattering amplitude in a Brillouin-Wigner perturbation expansion. Wave packets are used to introduce the initial conditions, thereby avoiding the necessity of adiabatically switching the coupling constant. The field of incident particles is second-quantized, and the target is first-quantized. The principal improvement on previous derivations is that the number of incident quanta, although finite, is otherwise unrestricted. The result is thus applicable, for example, to the nonrelativistic description of the scattering of a photon beam of arbitrary intensity by an atom or a charged particle. (auth)

**44319** EXTRACTION OF SINGULARITIES FROM THE S MATRIX. **Landshoff, P. V.; Olive, D. I. (Univ. of Cambridge, Eng.). J. Math. Phys. (N. Y.), 7: 1464-77 (Aug. 1966).**

Two methods are described for extracting triangle singularities from matrix elements. The first is comparatively simple but involves the use of off-mass-shell amplitudes; the second is rather involved. A proof of the Cutkosky discontinuity formula is given independent of perturbation theory, and it is shown that the Riemann-sheet properties of the singularity in the physical region agree with perturbation theory. The connection between this and a causality requirement is discussed. The relevance of the work to practical computations is explained. (auth)

**44320** GENERALIZED WARD IDENTITY AND UNIFIED TREATMENT OF CONSERVATION LAWS. **Lurie, D. (Dublin Inst. for Advanced Studies); Takahashi, Y.; Umezawa, H. J. Math. Phys. (N. Y.), 7: 1478-83(Aug. 1966).**

A technique for deriving conservation laws directly from field equations without recourse to the Lagrangians or Noether's theorem is reviewed and extended. The method allows a simple treatment of the so-called "generalized" conservation laws including Lipkin's "zilch." An interesting feature that results is the existence of conserved currents for discrete as well as continuous symmetries. It is also pointed out that conservation laws do not always follow from the invariance of equation of motion if it is not derivable from a Lagrangian. Finally, it is shown how the method can be applied to the normalization of wavefunctions of composite particles such as Bethe-Salpeter wave-functions. (auth)

**44321** ASYMPTOTIC PROPERTIES OF THE POTENTIALS IN THE INVERSE-SCATTERING PROBLEM AT FIXED ENERGY. **Sabatier, Pierre C. (Faculte des Sciences, Orsay, France). J. Math. Phys. (N. Y.), 7: 1515-31(Aug. 1966).**

The problem of finding a nonrelativistic central potential from a knowledge of all the phase shifts at one energy had been previously shown by Newton to reduce to the inversion of a given infinite matrix M. In the framework of Newton's theory, the solution is not unique but depends on one parameter. The inverse matrix is explicitly given, together with the vectors annihilated by M. These enable one to construct all the solutions of the problem. The asymptotic behavior of the equivalent potentials is exhibited, and it is shown that one (and only one) of them decreases asymptotically faster than $r^{-2+\epsilon}$, provided that the pulse shifts decrease asymptotically faster than $l^{-(3+\epsilon')}$ (for arbitrarily small $\epsilon, \epsilon'$). All the other equivalent potentials have an oscillating tail damped by a factor $r^{-3/2}$. The "transparent potentials," which give all phase-shifts equal to zero at one energy, are also studied. In subsequent publications, analytic continuation of the potentials in the r plane and of the Jost function in the angular momentum complex plane is studied. (auth)

**44322** THEOREM ON THE CLEBSCH-GORDAN SERIES IN A(l), B(l), C(l), AND D(l). Zaccaria, F. (Univ., Naples). J. Math. Phys. (N. Y.), 7: 1548-51(Aug. 1966).

By a general method, conditions are derived for A(l), B(l), C(l), and D(l), in order that terms and multiplicities of the Clebsch-Gordan series for the decomposition of the direct product of two irreducible representations be dependent on only one of them. (auth)

**44323** RELATION BETWEEN CHIRAL $SU_3$ x $SU_3$ CURRENT ALGEBRA AND $SU_6$. Amati, D. (CERN, Geneva. Univ., Trieste, Italy); Bergia, S. Nuovo Cimento (10), 45A: 15-28(Sept. 1, 1966).

The general structure of the covariant sum rules derived on the basis of chiral $SU_3 \times SU_3$ algebra is investigated in the case in which they are saturated by a finite number of intermediate states. The consistency of the saturation with states belonging to an $SU_6$ supermultiplet is discussed. It is found that consistency is ensured and that the $SU_3$ results for the renormalization ratios are obtained if mass differences between $SU_3$ multiplets are neglected. This is due to the fact that for equal masses and parities the matrix elements of the divergences of the axial currents are proportional to the matrix elements of the helicity. The situation is then discussed in which an arbitrary but limited set of states saturates all the matrix elements of the chiral $SU_3 \times SU_3$ algebra taken among them. It is shown that the matrix elements of the chiral algebra coincide with the matrix elements of a collinear $SU_3 \times SU_3$ algebra, so that the states that saturate the chiral algebra are a representation of the collinear one, on the basis of which the coupling constants can be calculated. The collinear group is not the same as the one generally considered as a subgroup of the static $SU_6$. It coincides with it only in the case of equal parities and masses of all the members of an irreducible representation. (auth)

**44324** l-EXCITATION IN $U_6 \otimes U_6$. Nwachuku, C. Okechuku (Imperial Coll. of Science and Tech., London). Nuovo Cimento (10), 45A: 58-64(Sept. 1, 1966).

A systematic study of the problem of further classification of higher boson resonances is conducted by deriving an approximated mass formula for the group $U_6 \otimes U_6$ $O_{31}$ for any given l. (auth)

**44325** DEGENERACY OF PHYSICAL VACUUM IN VECTOR MESON THEORIES WITH CONSERVED CURRENT. Lukierski, J. (Warsaw Univ.). Nuovo Cimento (10), 45A: 93-107(Sept. 1, 1966).

All possible Goldstone particles for linear vector field theories with conserved current are introduced. It is shown that if $m \neq 0$ we have one kind of these particles, and if $m = 0$ the number rises to four. They are all free and introduce the degeneracy of the vacuum state. In the case $m = 0$ two kinds out of the four cause the gauge transformations of four-potential operator $A_\mu$. The class of theories for which the Goldstone particles are decoupled from the physical part of the system is discussed. (auth)

**44326** SUM RULES FROM THE ALGEBRA OF CURRENT DENSITIES. Bouchiat, C.; Meyer, Ph. (Faculte des Sciences, Orsay, France). Nuovo Cimento (10), 45A: 108-23(Sept. 1, 1966).

A general method to derive sum rules involving mass-shell amplitudes from the algebra of space and time components of the current densities is developed. It is shown that the so-called Schwinger terms can be elminated in the quark model by a proper symmetrization. The case of vector currents is discussed for the spin-$\frac{1}{2}$ baryons and in particular the sum rules associated with the equal-time commutation relations of the magnetic moments. (auth)

**44327** ELECTROMAGNETIC FORM FACTORS FOR ARBITRARY SPIN. Theis, W. R. (Univ. of Minnesota, Minneapolis). Nuovo Cimento (10), 45A: 124-44(Sept. 1, 1966).

A covariant expansion of the matrix elements of the electromagnetic current is given for any spin. The invariant functions are connected with time-ordered products by an asymptotic condition for a (2s + 1)-component interpolating field. They are free of kinematical singularities. The interpretation for low-momentum transfer leads to the usual multipole expansion of the charge and the magnetic density. (auth)

**44328** CURRENT ALGEBRA AND MASS FORMULA. Faustov, R. (CERN, Geneva). Nuovo Cimento (10), 45A: 145-57(Sept. 1, 1966).

The Fubini-Furlan dispersion relation for current commutator is obtained in an unambiguous way and on its basis the general form of the mass formula is derived. It is then applied to get various relations among the electromagnetic mass differences. Two new formulas for the baryon decuplet are obtained and comparison with experiment is made. (auth)

**44329** QUASI-ANALYTIC FUNCTIONALS AND SELF-ADJOINTNESS OF FIELD OPERATORS. Gachok, V. P. (Inst. of Mathematics, Kiev). Nuovo Cimento (10), 45A: 158-65(Sept. 1, 1966).

The self-adjointness of the closure of the field operators is proved in field theory with quasi-analytic functionals. A complete investigation of the problem of moments in quantum field theory is made on the basis of this result. (auth)

**44330** REMARK ABOUT THE REGULARIZATION METHOD. Burdet, G.; Giffon, M. (Univ., Lyon). Nuovo Cimento (10), 45A: 166-8(Sept. 1, 1966).

A sufficient set of conditions are given for the validity of the regularization method in potential scattering for any linear momentum k and angular momentum l. (auth)

**44331** STRONG DECAY RATES AND $SU_3$. A COMPARISON AND CRITIQUE. Goldberg, M.; Leitner, J.; Musto, R.; O'Raifeartaigh, L. (Syracuse Univ., N. Y.). Nuovo Cimento (10), 45A: 169-78(Sept. 1, 1966).

A systematic comparison between the predictions of unbroken $SU_3$ and experiment regarding strong decays of accepted and potential supermultiplets is presented. It is found that the accepted supermultiplets ($J^P = \frac{3}{2}^+$, $1^-$, $2^+$) are in reasonable agreement with predictions, while the hypothetical $\frac{3}{2}^-$ and $\frac{5}{2}^+$ cases are not. (auth)

**44332** SPIN AND STATISTICS IN S-MATRIX THEORY. Lu, E. Y. C.; Olive, D. I. (Univ. of Cambridge, Eng.). Nuovo Cimento (10), 45A: 205-18(Sept. 1, 1966).

Starting from the S-matrix theory postulates of analyticity unitarity, connectedness and Lorentz invariance it is found that the connected parts for processes involving particles with the wrong-connection between spin and statistics vanish so that such particles are unobservable, provided the resultant singularity structure exhibits certain plausible features discussed in the text. (auth)

**44333** RENORMALIZABLE FIELD-THEORETICAL MODEL FOR WEAK INTERACTIONS. Banyai, L.; Rittenberg, V. (Inst. of Physics, Bucharest). Nuovo Cimento (10), 45A: 219-22(Sept. 1, 1966).

It is shown that a renormalizable model for weak interactions that gives an effective V-A theory can be constructed by implying some new unobserved particles and by a suitable choice of vertices. (L.B.S.)

**44334** GOLDSTONE'S THEOREM AND PARTIALLY CONSERVED CURRENTS. Maris, Th. A. J. (Univ. do Rio Grande do Sul, Porto Alegre, Brazil). Nuovo Cimento (10), 45A: 223-4(Sept. 1, 1966).

The problem of spontaneously broken symmetry generated by a nonconserved local current is studied in a classical model. An elementary calculation results in a simple modification of Goldstone's theorem which closely resembles the PCAC hypothesis in elementary-particle physics. (L.B.S.)

**44335** BOUND STATES OF A RELATIVISTIC SYSTEM. Calucci, G.; Fonda, L.; Ghirardi, G. C. (Univ., Trieste, Italy). Nuovo Cimento (10), 45A: 230-3(Sept. 1, 1966).

The Bethe-Salpeter equation is considered in the ladder approximation with the aim of obtaining upper bounds to the number of bound states in the case of two scalar particles interacting through a scalar field. (L.B.S.)

**44336** $SU_6$ ALGEBRA OF GELL-MANN AND FOUR-PION COUPLING CONSTANT. Mahanthappa, K. T.; Riazuddin (Univ. of Pennsylvania, Philadelphia). Nuovo Cimento (10), 45A: 252-5(Sept. 1, 1966).

The implications of the $SU_6$ algebra on strong interactions are considered; in particular, consistency conditions are obtained in the form of low-energy theorems. Using together the modified consistency conditions for pion-nucleon and pion-pion scattering the four-pion coupling constant $\lambda$ is obtained in terms of certain reduced matrix elements of a scalar operator which appear in the Gell-Mann-Okubo mass splittings. The predicted value of $\lambda$ comes out to be in good agreement with other determinations. (L.B.S.)

**44337** PHASE-SHIFT AMBIGUITIES FOR SPIN-INDEPENDENT SCATTERING. Crichton, J. H. (Seattle Pacific Coll.). Nuovo Cimento (10), 45A: 256-8(Sept. 1, 1966).

The assumption of a unique set of phase shifts for the treatment of scattering data is shown to be false by exhibiting a counter example. Ambiguities existing for nonvanishing phase shifts for spin-independent scattering are discussed, which are somewhat analogous to the Fermi-Yang ambiguities encountered in $\pi p$ scattering. (L.B.S.)

**44338** INTRINSIC MASS-SPLITTING IN A DE SITTER WORLD. Roman, P.; Koh, C. J. (Boston Univ.). Nuovo Cimento (10), 45A: 268-71(Sept. 1, 1966).

It is shown that within the framework of the de Sitter group a natural mass splitting of the correct order of magnitude occurs without the need of any kind of symmetry breaking. (L.B.S.)

**44339** MAXIMAL GROUPS AND THE POSSIBILITY OF THE DYNAMICAL ORIGIN OF INTERNAL SYMMETRIES. Ladanyi, K. (Research Group for Theoretical Physics, Budapest). Nuovo Cimento (10), 45A: 289-311 (Sept. 21, 1966).

A nonlinear spinor equation is considered which is form-invariant under the transformations of the $SO_8$ group. The formal interaction Lagrangian is characterized by V−A coupling and $GL(6,C)^{(+)} \otimes GL(6,C)^{(-)}$ invariance, with $GL(6,C)^{(+)}$ and $GL(6,C)^{(-)}$ referring to the positive and negative chiral projections of the field operator $t_m$, respectively. This group may be regarded as the maximal symmetry group of the four-trion interaction Lagrangians with V−A coupling. The dynamical properties are discussed along the lines suggested in a previous paper. An important damping of the leading singularities of the conventional chain interaction may occur, due to the nonperturbative correlation of trion-antitrion pairs. The possibility of the dynamical origin of all internal symmetries is discussed in detail. It is shown that, in the physical subspace of the space of states, the field equation of the $(6 \times 4)$-component spinor $t_m$, is equivalent to the simple nonlinear spinor equation of the 2-component Weyl spinor $\phi$, if the complete set of the Fock amplitudes and the field operator $t_m$ satisfy same conditions and additional commutation relations, respectively. The self-consistent fulfillment of these conditions has to be verified by explicit calculations. (auth)

**44340** GAUGE-INVARIANT MODEL OF QUANTUM ELECTRODYNAMICS WITHOUT SPINOR FIELDS. Prugovecki, E. (Univ. of Alberta, Edmonton, Can.). Nuovo Cimento (10), 45A: 327-80(Sept. 21, 1966).

A model of quantum electrodynamics is given exclusively in terms of gauge-invariant observable fields. The electromagnetic fields are obeying the conventional Maxwell equations. The rest of the fields, called the current fields and the gauge-invariant Dirac energy-momentum density fields, obey a system of algebraic and differential equations which are, in the ordinary quantum-mechanical case, equivalent to the system of Dirac equations. The theory is not formulated in terms of Hilbert-space concepts but rather in the language of the $\mathscr{T}$-formalism. Thus the direct construction of a theory of interacting fields is enabled, without the necessity of resorting to creation and annihilation operators or any Fock-space methods. (auth)

**44341** THE $SU_6$ ALGEBRA OF CURRENTS AND VECTOR MESON DECAYS. Altarelli, G. (Univ., Florence). Nuovo Cimento (10), 45A: 426-35(Sept. 21, 1966).

The commutation relations of the $SU_6$ algebra of integrated current densities are saturated with the mesons of the [35, L = 0] and [35, L = 2] representations of $SU_6 \otimes O_3(L)$ (L is the orbital angular momentum), assuming $SU_3$ and $SU_2(J)$ invariance where $J = L + S$ is the total angular momentum. The representation [35, L = 1] is not considered since the integrated current densities generating $SU_6$ have positive parity. The system of nonlinear equations so derived allows a physically interesting solution which is analyzed using the Goldberger-Treiman relation obtaining upper bounds and a relation for the $G_{\rho\pi\pi}$, $G_{\omega\rho\pi}$, and $G_{\varphi\rho\pi}$ coupling constants, in agreement with the present experimental situation. (auth)

**44342** PROPERTIES OF THE LEADING LANDAU CURVE OF THE SINGLE-LOOP SCATTERING DIAGRAM WITH AN INTERNAL DIAGONAL LINE. Barucchi, G. (Univ., Turin). Nuovo Cimento (10), 45A: 436-77(Sept. 21, 1966).

Using a determinantal formalism by Cayley, the algebraic and geometrical structure of the leading Landau curve of the single-loop scattering diagram was studied with an internal diagonal line. Several properties are derived for any values whatsoever of the masses. Particular emphasis is laid on the Plücker characteristics of the curve in question. (auth)

**44343** COMPLEX SINGULARITIES OF FEYNMAN DIAGRAMS. Aganovic, I. (Univ. of Zagreb. Inst. Ruder Boskovic, Zagreb). Nuovo Cimento (10), 45A: 478-86 (Sept. 21, 1966).

A characterization of complex singularities on the first sheet of an arbitrary Feynman diagram is given. The result is a generalization of the analysis given by Petrina for scattering diagrams. (auth)

**44344** SOLVABLE EXAMPLE OF REGGE POLES AT ZERO ENERGY. Cheng, H. (Massachusetts Inst. of Tech., Cambridge). Nuovo Cimento (10), 45A: 487-92(Sept. 21, 1966).

The solution of the radial Schroedinger equation at zero energy and its Regge poles was obtained in close form, for the potential $V_0 r^{b-2}/(1 + r^b)^2$, which is a superposition of Yukawa potentials. The asymptotic form $S(\lambda,s) \rightarrow \exp[2i\lambda\pi]$ as $|\lambda| \rightarrow \infty$ in the left-hand plane is confirmed in this case, with an exception pointed out. (auth)

**44345** COMPOSITENESS CRITERIA FOR CHANNELS CONTAINING MORE THAN ONE ELEMENTARY PARTICLE. Hagen, C. R. (Univ. of Rochester, N. Y.). Contract AT(30-1)-875. Nuovo Cimento (10), 45A: 505-9 (Sept. 21, 1966). (UR-875-155).

The $Z = 0$ compositeness criteria are examined in detail with the intention of demonstrating that the freedom one has in selecting a set of fundamental fields in the case of more than one elementary particle in a given channel is sufficient to guarantee the complete independence of the wave function renormalization for a suitably chosen set of canonical fields. (L.B.S.)

**44346** ON A RECENT CONTRACTION THEOREM FOR PSEUDO-ORTHOGONAL GROUPS. Mathews, P. M. (Univ. of Madras). Nuovo Cimento (10), 45A: 527-9(Sept. 21, 1966).

A contraction theorem was recently given leading from the proper homogeneous Lorentz group O(n-1,1) in n dimensions to the inhomogeneous rotation group IO(n-2). It is pointed out that this result is a special case of an n-dimensional version of a well-known result regarding little groups of the Lorentz groups. In the case of O(3,1) the little group which leaves a particular four-vector invariant is isomorphic to O(3), O(2,1) or IO(2), according as the invariant four-vector invariant is timelike, spacelike or lightlike. The proof of a corresponding result for O(m,n) is outlined. (L.B.S.)

**44347** NONUNIQUENESS OF N/D SOLUTIONS FOR SINGULAR POTENTIALS. Clement, G.; Jacquemin, A. (College de France, Paris). Nuovo Cimento (10), 45B: 52-5(Sept. 11, 1966).

The nonuniqueness of the solutions of the N/D equations for singular potentials which are characterized by asymptotic properties of the integral over the left-hand cut $\phi(s) = (1/\pi) \int_L \omega(s')ds'/(s' - s)$, where $\omega(s)$ is the discontinuity of the s-wave scattering amplitude, is pointed out. (J.F.P.)

**44348** ABSORPTION AND SCATTERING EFFECTS IN PERIPHERAL INTERACTIONS ACCORDING TO AN EXACTLY-SOLUBLE MULTICHANNEL FORMALISM. Tubis, A. (Purdue Univ., Lafayette, Ind.). Nuovo Cimento (10), 45B: 95-101(Sept. 11, 1966).

A formalism for investigating the conditions under which the Sopkovich formula is valid is presented. This formalism yields equations for the scattering amplitude which are trivially soluble and general enough, it is hoped, to have some link with the real world. The soluble multichannel-scattering formalism and its application to the peripheral model are considered. (J.F.P.)

**44349** COVARIANT FIELD THEORETICAL METHOD FOR THE STRUCTURE MODEL OF HADRONS. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 113-23(May 1966). (In Chinese).

According to the structure model of hadrons, the interaction of hadrons with the electromagnetic field takes place through the basic particles which form the hadrons. The rules for writing down the matrix elements of the electromagnetic and weak interactions are derived from the covariant quantum field theory. These rules also include the case when a meson appears in the intermediate state. These rules can easily be generalized to the case of baryons. (JPRS)

**44350** THE $\frac{1}{2}^+$ BARYON CURRENTS IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 124-36(May 1966). (In Chinese).

According to the structure model of hadrons, the interaction of baryons with photons and leptons is produced by the basic particles which form the hadrons. The $\frac{1}{2}^+$ baryon currents produced by five types (S, P, V, A, T) of interactions are derived from the covariant field theory. The structure effect gives rise automatically to the structure form factors which are functions of $q^2$ and completely determined by the inner wave functions of the baryons in terms of space coordinates. (JPRS)

**44351** BARYON CURRENTS $\frac{3}{2}^+ \rightarrow \frac{1}{2}^+$ IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 162-6(May 1966). (In Chinese).

In this paper, the matrix elements of $\frac{3}{2}^+ \rightarrow \frac{1}{2}^+$ baryon currents in the covariant structure model are computed, and compared with that of the $\tilde{SU}_{(12)}$ symmetry theory. (JPRS)

**44352** CONNECTION OF THE INNER MOVEMENT AND OUTER SYMMETRY WITH THE INDEPENDENT STRUCTURE FORM FACTORS OF BARYON CURRENTS IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 176-88(May 1966). (In Chinese).

If the spinor part of the wave function in the structure model satisfies the Bargmann-Wigner equation, then there are only two independent structure form factors in the baryon currents. One of the structure factors is related with the time-like and the longitudinal momentum of basic particles and contributes the $SU(6)_w$ symmetric part of baryon currents. Another one is related with the transverse momentum. It destroys the $SU(6)_w$ symmetry, but it makes no contribution except when the momentum transfer equals zero. The effect of renormalization or change of spinor structure is also discussed. (JPRS)

**44353** MESON CURRENTS IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 189-93(May 1966). (In Chinese).

According to the structure model, the interactions of mesons with photons and leptons are consequences of the electromagnetic and weak interactions of the basic particles which form the mesons. In the present paper, the $0^- \rightarrow 0^-$, $1^- \rightarrow 1^-$, and $0^- \rightarrow 1^-$ meson currents produced by five types (S, P, V, A, T) of interaction are derived by the covariant field-theory calculations. The structure effect produces automatically the structure form factors which are functions of $q^2$ and determined completely by the wave function describing the internal motion of the meson system. (JPRS)

**44354** ELECTROMAGNETIC AND WEAK DECAYS OF MESONS IN THE STRUCTURE MODEL. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 194-204(May 1966). (In Chinese).

The general form of the electromagnetic and weak currents of the mesons for the transitions $0^- \rightarrow 0^-$, $1^- \rightarrow 1^-$, $0^- \rightarrow 1^-$, and $1^- \rightarrow 0^-$ are obtained by the covariant field-theory calculations based on the structure model of hadrons. The following quantities are also calculated: the transition probabilities for the decays $\omega^0 \rightarrow \pi^0 + \gamma$, $\pi^- \rightarrow \mu^- + \tilde{\nu}$, $\omega^0 \rightarrow e^+ + e^-$ and $\pi^0 \rightarrow 2\gamma$; the form factor of the $K_{13}$ process; the Cabibbo angle for the weak decays of mesons; and the anomalous magnetic and anomalous electric quadrupole moments of the vector mesons. (JPRS)

**44355** CHARGE OF UR-HADRONS AND THE ELECTROMAGNETIC DECAYS OF VECTOR MESONS. Ho, Tso-hsiu. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 205-8(May 1966). (In Chinese).

The relations between the charges of the ur-hadrons and the electromagnetic decays of the vector mesons are discussed. The experimental results support the assumption that the ur-hadrons carry fractional effective charge. The values of 4-dimensional mesonic wave function at the origin of internal coordinates are also investigated. (JPRS)

**44356** SPACE-TIME SYMMETRY PROPERTIES OF THE STRUCTURE WAVE FUNCTIONS OF THE MESONS. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 209-12(May 1966). (In Chinese).

The general form of the structure wave functions of the $0^-$ and $1^-$ mesons is discussed based on the space-time symmetry properties of the fields of the basic particles. Space reflection and charge conjugation operations impose limitations on the number of independent spinor factors in the structure wave functions. The relation between $\chi$ and $\bar{\chi}$ is also discussed. The phase of the wave function which describes the internal motion of the meson is also determined (JPRS)

**44357** STRUCTURE WAVE FUNCTIONS OF MESONS AND THE BETHE-SALPETER EQUATION. Pei-Ching Ta Hsueh Hsueh Pao Tzu Jan K'o Hsueh, No. 2, 213-24(May 1966). (In Chinese).

The general properties of the structure wave functions of mesons are discussed based on the Bethe-Salpeter equation. The approximation is made that in the center-of-mass system the relative velocity between the basic particle and antiparticle is much smaller than the velocity of light. Discussions for the case of pseudoscalar meson are given in detail. It is shown that if the wave functions for $0^-$ and $1^-$ mesons are required to be nearly the same, the superstrong interaction must be of the scalar type or satisfy the condition $U_p f_p(p) = U_V f_p(p) = U_A f_p(p) = 2U_T f_p(p)$. Under the above approximation, the interaction at a distance in the center-of-mass system may be considered as simultaneous. Some properties of the pseudoscalar meson are obtained and the possible form of the wave functions is discussed. (JPRS)

**44358** THE $SU(6)_W$ ALGEBRA AT INFINITE MOMENTUM, ITS TENSOR CHARGES, AND ELECTRIC DIPOLES. Ademollo, M.; Gatto, R.; Longhi, G.; Veneziano, G. (Univ., Florence. Istituto Nazionale di Fisica Nucleare, Florence). Phys. Lett., 22: 521-4(Sept. 1, 1966).

A possible physical interpretation of tensor charges is critically analyzed, and from the comparison at infinite momentum of the $SU(6)_W$ algebra with the algebra of electric dipoles a number of relations among the axial and vector constants of baryons are deduced algebraically. (auth)

**44359** INTERPRETATION OF THE VARIATION OF CROSS SECTION WITH INCIDENT MOMENTUM FOR INELASTIC TWO BODY REACTIONS. Morrison, D. R. O. (CERN, Geneva). Phys. Lett., 22: 528-32(Sept. 1, 1966).

For elastic and inelastic two-body reactions at high energy, the variation of the cross section, $\sigma$, with the incident laboratory momentum, $p_{in}$, is shown to be consistent with the relationship $\sigma = \text{const. } p_{in}^{-n}$. For elastic or "elastic-like" reactions the values of the exponent, n, are found to be about 0; for non-strange meson exchange reactions, $n \approx 1.5$; for reactions with exchange of a strange meson, $n \approx 2.0$; and for baryon exchange reactions, $n \approx 4$. The results are discussed in terms of the absorption and Regge pole models. (auth)

**44360** CHARGE-CURRENT COMMUTATOR CONTRADICTED BY $\rho$-MESON DOMINANCE. Taylor, J. C. (Oxford Univ.). Phys. Lett., 22: 665-6(Sept. 15, 1966).

A sum rule derived from the covariance of a charge-current commutation relation is contradicted by $\rho$-meson dominance. (auth)

**44361** DOUBLE LOGARITHMIC ASYMPTOTICS OF QUANTUM ELECTRODYNAMICS. Frolov, G. V.; Gorshkov, V. G.; Gribov, V. N.; Lipatov, L. N. (Ioffe Inst. of Physics and Tech., Leningrad). Phys. Lett., 22: 671-3 (Sept. 15, 1966).

The double logarithmic asymtotics of various two-particle processes in quantum electrodynamics are investigated at high energy and at fixed momentum transfer. (auth)

**44362** NEW FAMILY OF SUM RULES FROM CURRENT ALGEBRA. Amati, D. (CERN, Geneva. Univ., Trieste, Italy); Jengo, R.; Remiddi, E. Phys. Lett., 22: 674-9(Sept. 15, 1966).

On the basis of current commutation relations a new family of sum rules is obtained. They involve invariant functions and integration variables different from those appearing in the Dashen, Gell-Mann-Fubini sum rules. The study of the singularities in the redundant variables allows conditions on the nucleon form factors to be obtained. (auth)

**44363** MULTIPLE FIELD RELATIONS. Delbourgo, R. (Imperial Coll. of Science and Tech., London); Salam, A.; Strathdee, J. Phys. Lett., 22: 680-3(Sept. 15, 1966).

An approximation scheme is suggested whereby, on the assumption that physical particles are quark composites, a common basis is found to emerge for three disparate elements in recent theory, namely: higher symmetry multiplet structure, algebra of weak currents and, PCAC. (auth)

**44364** MAGNETIC MONOPOLE AND TWO PHOTON THEORIES OF C-VIOLATION. Salam, A. (Imperial Coll. of Science and Tech., London. International Center for Theoretical Physics, Trieste, Italy). Phys. Lett., 22: 683-4(Sept. 15, 1966).

It is suggested that a modification of the magnetic monopole theory could be used to incorporate a possible C-violation of electromagnetic interactions. This modification implies the existence of a second "photon." (auth)

**44365** SIMPLE DYNAMICAL MODEL FOR BARYON RESONANCES. Slavnov, A. A.; Zavialov, O. I. (Steklov Mathematical Inst., Moscow). Phys. Lett., 22: 686-8 (Sept. 15, 1966).

The parameters of a number of baryon resonances are expressed in terms of few constants in the framework of the quark model. (auth)

**44366** SUM RULES FOR HIGH ENERGY SCATTERING PHENOMENA. Ahmadzadeh, A.; Chan, C. H. (Univ. of California, San Diego, La Jolla). Contract AT(11-1)-Gen-10. Phys. Lett., 22: 692-5(Sept. 15, 1966). (UCSD-10P10-6).

High energy scattering phenomena in which only the exchange of the $\rho$ and R trajectories contribute are considered. From the formalism combining SU(3) symmetry, exchange degeneracy and Regge poles a set of sum rules is obtained. These sum rules exhibit impressive agreement with existing data. (auth)

**44367** CONSEQUENCES OF AN APPROXIMATE $C_\gamma$ INVARIANCE OF THE PHYSICAL HADRONS. Horwitz, L. (Univ., Geneva); Ne'eman, Y. Phys. Lett., 22: 699-701 (Sept. 15, 1966).

An approximate $C_\gamma$ invariance in the presence of strong interactions, applicable to physical hadrons, is shown to imply a rough doubling of the hadron spectrum in which the new states could be heavier. (auth)

**44368** ANALYTIC EXPRESSION FOR A CLASS OF GREEN'S FUNCTIONS. Chew, H. (Western Reserve Univ., Cleveland). Phys. Lett., 23: 85-7(Oct. 3, 1966).

The Green's function $(H_0 - z)^{-1} = \int (\Sigma_1^n p_k^2 - z)^{-1} \exp (i \Sigma_1^n p_k \cdot r_k) \Pi_1^n d^3p_k$ for n free particles is evaluated in closed form for arbitrary n. (auth)

**44369** SPIN-$\frac{1}{2}$ SYSTEM WITHOUT INTRINSIC MAGNETIC MOMENT. Chang, Shau-jin (Harvard Univ., Cambridge, Mass.). Phys. Rev. Lett., 17: 597-9(Sept. 12, 1966).

A spin-$\frac{1}{2}$ system described by a third rank multispinor was examined. As a charged field, it describes a spin-$\frac{1}{2}$ system without intrinsic magnetic moment. The Lorentz invariance of the interacting system was verified. (auth)

**44370** DYNAMICAL MODELS AND MASS FORMULAS FOR RESONANCE MULTIPLETS. Kane, G. L. (Univ. of Washington, Seattle). Phys. Rev. Lett., 17: 719-20 (Sept. 26, 1966).

It is suggested that for multiplets which can be obtained by dynamical arguments based on forces generated by unitarity and inelastic effects, the assumptions that if SU(3) is a valid symmetry, resonances will occur in complete SU(3) multiplets, that except for mixing effects the masses in a resonance multiplet will satisfy a mass formula of the usual type, and that mass formulas for Regge recurrences will be the same as those for the lowest member on the trajectory may not be correct. Such multiplets may include the Regge recurrences of the baryon octet and decuplet, the multiplet which contains the $N^*_{\frac{1}{2}}(1518)$, and others. (J.F.P.)

**44371** ISOSPIN PROPERTIES OF ELECTROMAGNETIC INTERACTIONS. Dombey, Norman (Univ. of Sussex, Eng.); Kabir, P. K. Phys. Rev. Lett., 17: 730-2(Sept. 26, 1966).

Evidence for the $|\Delta T| \leq 1$ rule for electromagnetic interactions is examined and found wanting. Tests of the rule are suggested. (auth)

**44372** INTERACTIONS OF MASSLESS PARTICLES OF ARBITRARY SPIN. Dowker, J. S.; Dowker, Yih P. (The Univ., Manchester, Eng.). Proc. Roy. Soc. (London), Ser. A, 294: 175-94(Sept. 20, 1966).

The self-consistency problems arising when massless particles of higher spin are coupled to the electromagnetic and gravitational fields are investigated using a group theoretic method as opposed to the lagrangian approach employed by Fierz & Pauli (1939) in their discussion for massive particles. A massless particle of spin j is described by a 4j dimensional vector satisfying a generalization of Rumer's equation (1930). 2j + 1 of these 4j components form the conventional quantity associated with a particle of spin j and the remaining 2j − 1 are supernumerary quantities needed for the consistency of the interacting system; the whole object transforms according to the reduced representation $(j,0) \otimes (j-1,0)$ of the homogeneous Lorentz group. It is suggested that this formalism is a convenient way of writing higher-spin equations in particle-like form with attendant advantages. In the force-free case the 2j − 1 auxiliary quantities can be set equal to zero but this is not possible in the interacting system without inconsistency. One conclusion is that it is impossible for a (massless) particle of unique spin to be coupled minimally to gravitation unless either its spin is less than $^3/_2$, space-time is conformally flat, or its spin is two and it describes gravitation radiation itself. (auth)

**44373** CANONICAL ENSEMBLE FORMALISM FOR MULTIPLE PRODUCTION. Kohmura, Toshitake (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 36: 51-8(July 1966).

A canonical ensemble formalism is applied to multiple production. In the case that the particles produced are degenerate, the formalism is exact. The mass difference of the particles is taken into account and the results are consistent with the refined Fermi model. The multiplicity of particles is given by an easy calculation. (auth)

**44374** BEHAVIOR OF ELASTIC SCATTERING AMPLITUDES AT HIGH ENERGIES. Ida, Masakuni (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 36: 86-98(July 1966).

A Laplace representation of the high-energy elastic scattering amplitude is introduced, which seems convenient for describing the observed sharp decrease of the differential cross sections in the forward direction. It is found that the imaginary part of the determining function of the Laplace transform has a Gaussian peak, with an exponential tail outside. This behavior of the determinining function is discussed from a more general point of view, on the basis of another integral representation of the diffraction part of the scattering amplitude. The momentum transfer dependence of the elastic scattering amplitude is also investigated. (auth)

**44375** UNIVERSALITY OF THE STRONG INTERACTION OF HADRONS. Matumoto, Ken-iti; Takenaka, Akira (Univ. of Kanazawa, Japan). Progr. Theoret. Phys. (Kyoto), 36: 99-106(July 1966).

The characteristics of the strong interaction of hadrons are investigated phenomenologically. It is shown that the strong interactions of hadrons have a certain kind of universality and are fairly well consistent with $SU_3$ invariance. It is pointed out that the known baryons having the above mentioned universal strong interaction satisfy the Ogawa relation. It is shown that there exists another kind of baryons having another kind of strong interactions. (auth)

**44376** FUNDAMENTAL TRIPLET AND ITS NEW DEGREE OF FREEDOM. Hori, Shoichi (Univ. of Kanazawa, Japan). Progr. Theoret. Phys. (Kyoto), 36: 131-7(July 1966).

The urbaryons which form a triplet state with respect to the usual $SU_3$ group are assumed also to belong to the three-dimensional representation of the new $SU_3$ group. It is assumed further that the forces between urbaryons and/or anti-urbaryons are mediated by a vector meson which is a singlet with respect to the usual $SU_3$ and an octet with respect to the new $SU_3$ group. Under these simple assumptions the essential features of the urbaryon dynamics can be understood at least in the nonrelativistic approximation which seems to be valid for bound states of massive urbaryons and/or anti-urbaryons. For example one can show that the potential energy between an urbaryon and an anti-urbaryon is twice as attractive as the potential between two urbaryons, and stable bound states are confined to the states which belong to the regular representations (1, 8, 10, . . .) of the usual $SU_3$ group and are singlets with respect to the new $SU_3$ group. Thus the meson states and baryon states are understood on the same footing. No para-statistics is necessary. These urbaryons may be quarks, but it is shown that there is the possibility of assigning integral charges to the urbaryons. (auth)

**44377** MULTICHANNEL SCATTERING AND EQUIVALENCE BETWEEN FOUR-FERMION AND YUKAWA COUPLING. Yabuki, Haruichi (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 36: 138-47(July 1966).

An intermediate type of solution to the multichannel N/D equation is investigated. It is found that the number of independent parameters contained in the subtraction constant matrix $N(\infty)$, which may be considered as renormalized direct coupling constants, is at most n in the n-channel case. In order to see the meaning of this reduction of the number of free parameters, a multichannel Zachariasen model is examined in detail. It is found that this reduction is reflected in the effective reduction of the number of free parameters of the bare direct coupling constants $\lambda$, i.e., the effective factorizability of $\lambda$. This result may be considered as a suggestion of the equivalence between the four-Fermi theory and the Yukawa theory in the multichannel case. (auth)

**44378** COMMENT ON THE MASS FORMULAS DERIVED FROM GROUP THEORY. Katsumori, Hiroshi (Institut Henri Poincare, Paris). Progr. Theoret. Phys. (Kyoto), 36: 148-58(July 1966).

The mass operator is assumed to be written in the form of the most general polynomial expression in the hypercharge, the isospin and its third component or equivalently the electric charge. It is shown that the Coleman-Glashow formula for the electromagnetic mass difference can generally be obtained by omitting the contributions from the interference effect of the strong mass splitting interaction and the electromagnetic interaction, independently of a special type of the group, such as $SU_3$. Furthermore strong mass splitting problems are discussed in connection with the Gell-Mann and Okubo formula and also with the Vigier and Flato formula. (auth)

**44379** SYMMETRY OF STRONG AND WEAK INTERACTIONS. Nakamura, Seitaro; Sato, Shigeo (Tokyo Univ. Univ. of Nihon, Tokyo). Progr. Theoret. Phys. (Kyoto), 36: 159-74(July 1966).

By using two kinds of spin operators $\tau_i$ and $\zeta_i$, the selection rules for strong and weak interactions as well as the grouping of particles are considered. The $\tau_i$ are identified with the ordinary isotopic spin operators. The $\zeta_i$ are called hyperspin operators, and the eigenvalue of $\zeta_3$ represents half of the hypercharge. Thus $\Lambda$ (and the $\eta$ meson) are assigned to the representation $D_{0,0}$, $\Sigma$ (and the $\pi$ meson) to $D_{1,0}$, N, and $\Xi$ (and the K, $\overline{K}$ mesons) to $D_{½,½}$. Also the unknown multiplet of $D_{0,1}$ for baryons (called the v particle) and for mesons (the D meson) is considered: $v^+$ (Y = +2, I = 0) may correspond to the $Z^+$ particle, $v^0$ (Y = 0, I = 0) to $Y_0^*$ (1405 Mev) and $v^-$ (Y = −2, I = 0) to $Q^-$ (1675 Mev). Also $D^\pm$ (Y = ± 2, I = 0) may correspond to the Dubna-Yamanouchi-Kaplon meson, and $D^0$ (Y = 0, I = 0) to the $X^0$ (960 Mev) meson. For the strong interactions, invariance under the transformations of the four-dimensional orthogonal group which is the direct product of two three-dimensional orthogonal groups generated by $\tau_i$ and $\zeta_i$, respectively is required. For the weak interactions in the nonleptonic mode the invariance $\Delta|\tau + \zeta| = 0$ is required. It is shown that this selection rule is closely related to the usual $\Delta I = ^1/_2$ rule. Moreover by assuming that the two pairs $(\mu^+, \nu_\mu)$ and $(\nu_e, e^-)$ belong to spinor representations of the three-dimensional rotation group generated by $\tau_i + \zeta_i$, the selection rule for the weak interactions in the leptonic mode is formulated in a way similar to that for the nonleptonic mode. The electric charge Q of the leptons is given by $Q = \tau_3 + \zeta_3 + h$ ($h = ^1/_2$ for the muon group, and $h = -^1/_2$ for the electron group). The conservation of electric charge, therefore, imposes the selection rule $\Delta h = 0$, and this leads to a unique choice of the neutrino nonflip case. (auth)

**44380** RADIATIONLESS CONDITION AND RENORMALIZATION. Hokkyo, Noboru (Hitachi Central Research Lab., Ozenji, Japan). Progr. Theoret. Phys. (Kyoto), 36: 175-80(July 1966).

The space-time behavior of the n-th elementary particle is represented by a trajectory with changing direction of time, the distance between adjacent kinks of the trajectory being L/n where L is the classical electron radius. L is numerically the distance between charge irregularities of the universe $R/\sqrt{N_e}$, where $N_e$ is the number of electrons in the universe of radius R. The radiationless condition for a point charge moving along this trajectory gives Nambu's mass formula. Another consequence of the radiationless condition is to cut off short wavelength components of self-action virtual quanta at ~L and guarantee a finite mass correction. It is also seen that the short wavelength (< L) components are the very components that concentrate the charge (particle) within a small spatial distance ~L and give rise to the major part of the observed mass. (auth)

**44381** CALCULATION OF BOSON MASS LEVELS BASED ON THE COMPOSITE MODEL. Aoki, Masanori (Univ. of Kanazawa, Japan). Progr. Theoret. Phys. (Kyoto), 36: 181-2(July 1966).

In order to treat a hadron system with nonrelativistic dynamics on the basis of the composite model, a certain hamiltonian is taken for a boson system as a trial example, and the characteristics of the LS force between an urbaryon pair are studied. (J.F.P.)

**44382** EQUATION OF MOTION OF ELEMENTARY PARTICLE FROM UNIFIED APPROACH. Takabayasi, Takehiko (Univ. of Nagoya, Japan). Progr. Theoret. Phys. (Kyoto), 36: 185-7(July 1966).

The equation of motion is displayed for the model built on internal coordinates consisting of triple 2-component spinors. In the unified approach this equation represents the unique equation of motion governing elementary particles in the free case. The underlying view is that there are particles in the SU(6) classification pattern which should be described properly at the level of free particles. (J.F.P.)

**44383** UNIFIED WAVE EQUATION FOR ELEMENTARY PARTICLES. Kase, Hiromi; Takabayasi, Takehiko (Univ. of Nagoya, Japan). Progr. Theoret. Phys. (Kyoto), 36: 187-9(July 166).

The wave equation corresponding to the Heisenberg equation of motion, given previously in terms of spinor internal coordinates, is discussed, and it is shown that it really represents the unified wave equation of particles at the one-particle level. The model is treated as built on a single spinor. (J.F.P.)

**44384** REAL AMPLITUDE IN HIGH ENERGY ELASTIC SCATTERING. Hama, Mitsuru; Sumi, Yoshio (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), 36: 190-1(July 1966).

The real amplitude in high energy elastic scattering is discussed. This amplitude is derived from the conventional unitary assumption for the imaginary amplitude. The overlap function of inelastic final states is taken as a gaussian. The calculated partial wave amplitude is shown for several sets of the parameters. It is seen that the contribution to the cross section from higher partial waves of the real amplitude becomes very large compared with that of the imaginary one. (J.F.P.)

**44385** OBSERVATIONS ON THE SYMMETRY TRANSFORMATION OF THE DIRAC FIELD. Gabos, Zoltan; Vaida, Mihai. Stud. Cercet. Fiz., 18: 643-53(1966). (In Rumanian).

The discrete symmetry transformations of the Dirac field were systematically examined. The difficulties reported by G. Lüders and P. Roman in the demonstration of the invariance of the Dirac equation and of the anticommutation relations were eliminated. It was concluded that this group consists of 32 operations that could be ultimately reduced to 6 independent ones. The equation of motion and the anticommutation relation are covariant with respect to the discrete symmetry operations. Investigating the connection between the discrete symmetry operation group and the Lorentz group, the conditions were established for which the order of the symmetry operations and Lorentz transformations may be inverted. The only difference between the phase factors of the 6 transformation obtained was found to be the sign. (TTT)

**44386** JOST FUNCTIONS, THE LEVINSON THEOREM, AND MULTICHANNEL PROBLEMS IN THE RELATIVISTIC THEORY OF THE S MATRIX. Stihi, M.; Visinescu, M. (Inst. for Atomic Physics, Bucharest). Stud. Cercet. Fiz., 18: 751-71(1966). (In Rumanian).

Continuing a previous study of Jost functions and of the S matrix within the framework of the potential theory for the nonrelativistic case on the basis of the Schrödinger equation, the results were extended to the relativistic case. The place of the potential was assumed to be a discontinuity at an intersection with the S matrix and an integral equation was used to determine the Jost function instead of Schrödinger differential equation. The elastic scattering of two particles of equal mass was studied first, as the simplest case. It was found that it is an analog of the Jost function. Afterwards, Levinson's theorem was applied to this case, taking into account the Castillejo, Dalitz, Dyson (CDD) poles, deriving a method for obtaining integral equations of this function. The singularities of the S matrix, produced by the introduction of a CDD pole were then examined on the basis of a simplified model, applying this formalism to multichannel reactions. (TTT)

**44387** SIX-DIMENSIONAL FORM OF DIRAC MATRIX ALGEBRA. Stepanovskii, Yu. P. (Ukrainian Inst. of Physics and Tech.). Ukr. Fiz. Zh., 11: 813-24(1966). (In Ukrainian).

The isomorphism $SL\ (4, C)/Z_2 \sim SO\ (6, C)$ is constructed as an extension of the isomorphism $SL\ (2, C)/Z_2 \otimes SL'\ (2, C)/Z_2' \sim SO\ (3, C) \otimes SO'\ (3, C)$. The six-dimensional form of Dirac matrix algebra is considered. The relation of Pauli's fundamental theorem on Dirac matrices with the existence of the isomorphism $SL\ (4, C)/Z_2 \sim SO(6, C)$ is investigated. (auth)

**44388** ON A SPINOR FIELD. Pyt'ev, Yu. P. Vestn. Moskov. Univ., Ser. III: Fiz. Astron., No. 3, 9-12(May-June 1965). (In Russian).

Some properties of spinor fields for external electromagnetic fields $A_i$ are examined. Spinor fields W, satisfying the second order system $1G^{\sigma\mu}W_{\sigma\mu} - \frac{1}{2}{}^{ij} f_{ij}W_4 = 0$, $W_\sigma = \partial W/\partial x^\sigma$, $2\sigma^{ij} = \gamma^i\gamma^j - \gamma^i\gamma^j$, $f_{ij} = \partial g_i/\partial x^i - \partial g_i/\partial x^j$, $g_i = e/mc^2\ A_i$, are considered. The systems investigated make it possible to follow the analogy with the case of scalar field and show a great simplicity in comparison with the solutions studied for first order spinor fields. Between the fields W and U bonds exist: in known fields U exists from the relation $U = \gamma^5\gamma^\mu W_\mu$, $\gamma^5 = \gamma^0\gamma^1\gamma^2\gamma^3$. If the solutions of the second-order equations are examined, agreement with the relation $\gamma^5\chi^\pm = \pm\chi^\pm$, $\chi^\pm = (1 \pm \gamma^5)W$, then mutual correspondence can be established between them and U. Some characteristics of the systems were reported. (tr-auth)

**44389** ENERGY-MOMENTUM TENSOR OF INTERACTING FIELDS. Efimov, Z. F. Vestn. Moskov. Univ., Ser. III: Fiz. Astron., No. 3, 13-20(May-June 1965). (In Russian).

For scalar and vector mesons during their interaction with electromagnetic fields, it was shown that the description of such systems in terms of wave functions of weak fields in the Lagrangian formalism leads to logically contradictory results. If the description of the system examined is made in terms of wave functions, satisfying equations of interacting fields, then the energetics of this closed system are characterized by this field Lagrangian and the symmetrization of the canonical tensor is possible only for the entire systems and not for each of their interacting fields. (tr-auth)

**44390** COORDINATE TRANSFORMATION AND COMPENSATING FIELDS. Konopleva, N. P. Vestn. Moskov.

Univ., Ser. III: Fiz. Astron., No. 3, 73-80(May-June 1965). (In Russian).

The theory of compensating fields for the case of coordinate transformation was developed. The method used in the work gives equations of the Einstein type for all fields. These equations determine the energy-momentum tensor of the corresponding fields. (tr-auth)

**44391** RELATION BETWEEN THE FORM-FACTOR OF A SINGLE PARTICLE MATRIX ELEMENT OF THE ENERGY-MOMENTUM TENSOR AND THE CHARGE AND MAGNETIC MOMENT. Petukhov, B. V.; Polyakov, Yu. I.; Shirokov, Yu. M. (Scientific Research Inst. of Nuclear Physics, USSR). Vestn. Modkov. Univ., Ser. III: Fiz. Astron., No. 5, 14-17(Sept.-Oct. 1965). (In Russian).

The strongest singularities of the matrix element of the energy-momentum tensor of a single particle, together with the charge and magnetic moment, were determined. The coefficients in the presence of singularities were expressed by charge and magnetic moment. (tr-auth)

**44392** STABILITY OF STATIONARY STATES OF NONLINEAR VECTOR FIELD. Rybakov, Yu. P. Vestn. Moskov. Univ., Ser. III, Fiz. Astron., No. 1, 72-80(Jan.-Feb. 1966). (In Russian).

Invariants describing classical nonlinear vector fields were selected on the basis of a stability hypothesis. Conditions required for stationary particle motion were found. It was shown that the stability hypothesis and Coulomb law are sufficient for developing Maxwell equations for the finite linear case of small fields. (R.V.J.)

**44393** SCATTERING PHASE SHIFT IN STOCHASTIC FIELDS. Ramakrishnan, Alladi (Inst. of Mathematical Sciences, Madras); Vasudevan, R.; Srinivasan, S. K. Z. Phys., 196: 112-22(1966).

A very simple model of a spherically symmetric potential like $\mu/r$, with $\mu$ varying randomly along r, the distance from the scattering center is analyzed, and it is found that if $\mu$ changes its sign in a stochastic fashion, the average potential felt at each point r consists of a coulomb part as well as a short range Yukawa type component. Using the nonlinear equations for the phase function for potential scattering of a Schrödinger particle, the average and other moments of the phase shifts can be computed in certain approximations. (auth)

**44394** RELATIONS BETWEEN THE ELECTROMAGNETIC FORM FACTORS OF THE $0^-$- AND $1^-$-MESONS FROM THE COLLINEAR GROUPS SU(3) ⊗ SU(3) ⊗ U(1) AND $SU(6)_W$. Hefft, Klaus (Univ., Heidelberg). Z Phys., 196: 143-62(1966).

The relations between the electromagnetic matrix elements of the 18 low-lying pseudoscalar and vector mesons predicted by the collinear groups SU(3) ⊗ SU(3) ⊗ U(1) and $SU(6)_W$ are derived. Using the hermiticity of the electromagnetic current operator, charge conjugation invariance and invariance under the full Lorentz group and SU(3)-symmetry separately, all electromagnetic matrix elements of these mesons are described by seven independent real form factors. After combining space-time with intrinsic properties of the particles this number is reduced to four by the minimal collinear group SU(3) ⊗ SU(3) ⊗ U(1) and to three by $SU(6)_W$ which involves more speculative assumptions. In the limit of low momentum transfer the predictions of both models become identical, depending on three real quantities. No disagreement with experiment was found, as far as a comparison is possible. (auth)

**44395** SPONTANEOUS VIOLATION OF STRONG INTERACTION SYMMETRY AND THE ABSENCE OF ZERO-MASS PARTICLES. Migdal, A. A.; Polyakov, A. M. Zh. Eksp. Teor. Fiz., 51: 135-46(July 1966). (In Russian).

The existence of zero-mass particles under spontaneous violation of symmetry is considered. Summation of all Feynman diagrams yields for the difference between the mass operators $M_a(p)-M_b(p)$ of particles a and b in a supermultiplet an equation that is identical with the Bethe-Salpeter equation for the wave function of a zero mass scalar bound state (zeron) in the annihilation channel ab of the particles. It is demonstrated that in spontaneous violation of symmetry in a Yang-Mills type theory with vector mesons the zerons interact only with virtual particles and hence are unobservable; vector mesons on the other hand acquire a mass despite the generalized gauge invariance. It is proved that an asymmetric solution corresponds to a minimal vacuum energy and that a consequence of C-invariance of the solution is conservation of strangeness. (auth)

**44396** ANALYTIC PROPERTIES OF THE SCATTERING AMPLITUDE IN A THEORY INVOLVING A $g\varphi^4$ LAGRANGIAN. Tabachenko, A. N. Zh. Eksp. Teor. Fiz., 51: 462-5(Aug. 1966). (In Russian).

The analytic properties of the scattering amplitude with respect to the coupling constant g and angular momentum $\lambda$ are considered. It is found that for a potential $b/x^2 \ln x$ in a theory with a $g\varphi^4$ interaction Lagrangian, the scattering amplitude is analytic with respect to g at $g = 0$ and possesses a branching point at $\lambda = 0$ for $k^2 = 0$. (auth)

**44397** SINGULARITIES OF THE ELECTRON GREEN FUNCTION. Braun, M. A. (Leningrad State Univ.). Zh. Eksp. Teor. Fiz., 51: 606-11(Aug. 1966). (In Russian).

It is shown that in the range where $d_1 = 3$ the electron Green function does not contain infrared divergences and possesses purely a pole singularity at a point corresponding to the physical electron mass. The character of the singularity of the nonpolar part is also elucidated. (auth)

**44398** INCOHERENT ELECTROMAGNETIC WAVE SCATTERING IN A COULOMB FIELD. Yakovlev, V. P. Zh. Eksp. Teor. Fiz., 51: 617-27(Aug. 1966). (In Russian).

The scattering of circularly polarized waves in a Coulomb field involving the coalescence of two wave quanta to form one quantum of double frequency is considered by employing the exact Green functions for an electron in the field of a plane electromagnetic wave. The scattering matrix element is investigated for a low intensity wave (perturbation theory) and for the case of low frequencies and comparatively arbitrary intensities. (auth)

**44399** SOLUTION OF TWO PLANE WAVE SCATTERING PROBLEM IN NONLINEAR SCALAR FIELD THEORY OF THE BORN-INFELD TYPE. Barbashov, B. M.; Chernikov, N. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz., 51: 658-68(Aug. 1966). (In Russian).

The problem of scattering of two plane waves is formulated and solved exactly in classical nonlinear mesodynamics of the Born-Infeld type. It is found that the shape and direction of the plane waves do not change after scattering. Only a shift of the arguments $x - t$ and $x + t$ occurs by an amount which depends on the wave momenta. The solution is obtained on the basis of the Cauchy problem for the relevant equation. It is shown that it may be a multivalued function of x and t. (auth)

**44400** INTRODUCTION TO STRONG INTERACTIONS. A LECTURE-NOTE VOLUME. Park, David. Lecture Notes and Supplements in Physics. New York, W. A. Benjamin, Inc., 1966. 264p. $9.00 cloth; $4.95 paperback.

Basic concepts of the theory of interacting fields are presented, and it is shown how they form the foundation for modern theory. The relation of fields to potential interactions are studied. In this study scattering is analyzed, and features which persist in new theory are pointed out. It is shown how a few general physical principles aid in the construction of relativistic scattering amplitudes for two-particle processes. An introduction to dispersion relations, and a brief account of how these relations lead to a phenomenological analysis of nucleon-nucleon interactions are given. The consequences of symmetries for a theory of strongly interacting particles are considered, and dispersion relations are expanded to include crossing symmetry. (J.F.P.)

**44401** QUANTUM EQUATION AND THE THEORY OF FIELDS. Flint, H. T. Methuen's Monographs on Physical Subjects. New York, John Wiley and Sons, Inc., 1966. 154p. $6.25.

The quantum equation is extended in order to relate it to field theory. Field theories in their unquantized form which have been applied in theories of the nuclear field are discussed. The physical interpretation of all the parameters introduced in the description is pointed out, and this leads to an emphasis upon localization in the physical world rather than upon its geometric properties. Quantum and field equations are derived from the principles of Hamilton and Lagrange and the geometrical forms of relativity theory. The Dirac quantum equation is also derived by applying the Weyl principle. (J.F.P.)

## Fluid Physics and Thermodynamics

***See also* Plasma Physics and Thermonuclear Processes**

*Refer also to abstract 44166.*

**44402** (AD-628065) EXTRA THERMAL IONIZATION AND MHD FLOWS. Final Report. Sherman, Arthur (General Electric Co., Philadelphia, Pa. Missile and Space Div.). Oct. 15, 1965. Contract AF49(638)-1465. 5p. (AFOSR-65-2237). CFSTI $1.00 cy, $0.50 mn.

Investigation is described of the interaction between extra-thermal ionization and MHD flows. The motivation for such research has been related research (experimental) into crossed field devices utilizing extra-thermal ionization to enhance electrical conductivity. (auth)

**44403** (AD-628143) ELECTRON AND ION DENSITY AHEAD OF AIR SHOCK WAVES. Final Report, October 1, 1964-November 30, 1965. Weymann, Helmut D. (Rochester Univ., N. Y. Dept. of Mechanical and Aerospace Sciences). Jan. 18, 1966. Contract AF-AFOSR-478-65. 4p. (AFOSR-66-0169). CFSTI $1.10 cy, $0.50 mn.

Electron and ion density measurements ahead of strong shock waves are described. Measurements were made with a new collecting probe in a pressure driven shock tube with argon on the experimental gas. For initial pressures of 5 mmHg and Mach numbers of about 10 plasma density profiles were measured up to 150 cm ahead of the shock. (auth)

**44404** (AD-628179) NUMERICAL INTEGRATION OF THE EQUATIONS OF MOTION OF A VISCOUS FLUID. PART I. Final Report. Gillis, J.; Brandt, A. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Applied Mathematics). Aug. 25, 1965. Contract AF-EOAR-73-63. 5p. (AFOSR-65-2213(Pt.1)). CFSTI $1.10 cy, $0.50 mn.

A brief review is given of work on the development of methods for solving the equations of motion of magnetohydrodynamics, taking account of viscous effects. The case of an electrically conductive fluid in an external transverse magnetic field is investigated. When the external field is zero, the equations reduce to those of Navier-Stokes. Several checks to the accuracy of the solutions are considered. (auth)

**44405** EXISTENCE THEOREM FOR CERTAIN STATIONARY STATES WITH REYNOLDS MAGNETIC NUMBER ZERO. Sanchez Palencia, Enrique (Ciudad Univ., Madrid). Compt. Rend., Ser. A, 263: 141-4(July 18, 1966). (In French).

The stationary flow of a charged, incompressible, viscous fluid surrounding a solid, electrically conducting obstacle in presence of a magnetic field is considered. It is shown that a weak solution exists for the case when the Reynolds magnetic number is zero, while the classical Reynolds number is arbitrary. If the classical number is zero also, the solution is unique. (tr-auth)

**44406** CALCULATION OF THE BOUNDARY-LAYER FLOW ON AN ELECTRICALLY CONDUCTIVE WALL OF A FLAT CHANNEL. Paskonov, V. M.; Yakubenko, A. E. Izv. Akad. Nauk SSSR, Mekh. Zhidkosti Gaza, No. 3, 12-19 (1966). (In Russian).

Magnetohydrodynamic boundary-layer-flow equations, based on the numerical calculation methods used for the boundary layer of a nonconducting fluid, are analyzed by separating the problems of a flow inside the flow center and of a flow within the boundary layer. The problem of finding the characteristics inside a flowing gas center is reduced to the solution of a differential equation with the boundary conditions for subsonic and supersonic flow. For both, the numerical evaluations of flow characteristics were used for solving the equations of the boundary layer. It was found that with an M = 3 inflow, and values of the dimensionless flow parameters K greater than 0.5, the generator begins to act as an accelerator at a specific section; the greater the K, the nearer this section is to the inflow section. For the flow rating in the boundary layer, a system of differential equations with partial derivatives at small Reynolds magnetic numbers is performed and numerically solved for given boundary conditions, using the finite-difference method and a standard "Strela" computer program. The resulting dependences of M, speed, and temperature profiles on dimensionless parameter K, characterizing the liquid rate, are used to calculate the characteristics of the heat flow and the resistance on the surface of the conducting wall. They are expressed as functions of the resistance, Reynolds number, and Nusselt's heat-transfer number, and are plotted in curves demonstrating that a separation of the flow from the wall takes place nearly in the center of the channel ($x \approx 0.53$). This is explained by the fact that with a supersonic flow in a channel of constant section, the speed of a conducting gas decreases while its pressure increases. The pressure across the boundary layer does not vary; therefore, a force directed against the flow direction is generated near the wall and effects the separation of the boundary layer. An analysis of the resistance of the boundary layer in a subsonic flow reveals that it is negligible in comparison with the resistance of the flow center in the case of a channel with $L/2h \sim 1$ ($L$ = length, $h$ = distance between the walls) at a Reynolds number of about $10^6$ at the inflow section. (ATD)

**44407** AVERAGING OF MAGNETOHYDRODYNAMIC FLOWS AND THE APPLICABILITY OF A HYDRAULIC APPROXIMATION FOR THE CALCULATION OF MAGNETOHYDRODYNAMIC FLOWS THROUGH CHANNELS. Lyubimov, G. A. Izv. Akad. Nauk SSSR, Mekh. Zhidkosti Gaza, No. 3, 3-11(May-June 1966). (In Russian).

During investigations in gas dynamics of the same nonuniform flow, the results of hydraulic calculation may differ by as much as 10, depending on the method of averaging. Consequently, a comprehensive investigation of the problem of averaging of flows was made, and shows, for selected examples, that the nonuniformity of MHD flows is much stronger than in gas dynamic currents because of the nonuniformity of the force and thermal interactions of currents within the flows. These increased nonuniformities lead, in turn, to even larger fluctuations in the results of hydraulic calculations, and it is concluded that there is a definite need for the development of hydraulic calculational methods based on nonuniform (in the hydrodynamic and electrodynamic sense) canonical flows. Such an approach appears in many cases as the only one applicable for practical design of MHD equipment. (JPRS)

**44408** COMPUTATION OF THE BOUNDARY LAYER ON THE ELECTRICALLY CONDUCTING WALL OF A FLAT CANAL. Paskonov, V. M.; Yakubenko, A. E. Izv. Akad. Nauk SSSR, Mekh. Zhidkosti Gaza, No. 3, 12-19(May-June 1966). (In Russian).

The motion of electrically conducting liquids in the boundary layers formed on electrodes or non-conducting walls of magnetohydrodynamic devices is of great practical interest; however, the methods used for solving boundary layer equations are based on simplifying assumptions in order to be able to use ordinary differential equations. If a magnetic field is applied on the flow, a special solution may be obtained. It was attempted to solve the magnetohydrodynamic equations of the boundary layer by applying a computational method that has been used for boundary layer problems of nonconducting fluids. The problem considered relates to an electrically conducting gas flowing between two parallel flat plates within a transversal magnetic field. It was assumed that the plates were made of an ideally conducting material kept at a constant potential. The calculations indicated that a force directed against the flow arises near the wall, resulting in the removal of the boundary layer. (TTT)

**44409** RELATIVISTIC HYDROMAGNETIC WAVES AND GROUP VELOCITY. **Giere, Albert C. (Pennsylvania State Univ., University Park). J. Math. Phys., 7: 1648-55 (Sept. 1966).**

The velocities of relativistic hydromagnetic waves in a compressible, perfect fluid of infinite conductivity are calculated in the framework of general relativity. In the absence of viscous and Joule heat losses, the flow is isentropic, and, therefore, the wave surfaces are propagated without change of shape. The velocities are first obtained in terms of the four-vector magnetic field and then in terms of the three-dimensional field. Several limiting cases are considered, and, in particular, it is shown under what conditions the expressions reduce to the nonrelativistic forms. Finally, the group velocities are calculated. The existence of a group velocity for such waves is based on the fact that the velocities exhibit a directional dependence. The group velocity in this case is of significance because it is the velocity of energy propagation, just as in the case when dispersion exists. (auth)

**44410** DISCHARGE DYNAMICS IN THE LARGE DIAMETER MAGNETICALLY CONFINED ION GAS LASER. **Ahmed, S. A.; Faith, T. J. Jr. (RCA, Princeton, N. J.). Proc. IEEE (Inst. Elec. Electron. Eng.), 54: 1470-1 (Oct. 1966).**

Experiments were carried out on a d-c, magnetically confined argon laser discharge in an 8-mm bore, 40-cm long quartz tube situated in a 1500-gauss axial magnetic field. The results show that at high currents ion drift effects cause the gas pumpout to reverse from the more familiar pumping toward the anode to pumping toward the cathode. It is seen that for large diameter magnetically confined discharge tubes, the gas density in the tube is first reduced by ion mobility and charge exchange collisions to a level where both electron temperature and density are sufficiently increased to permit laser oscillation. These pressure effects and the consequent density gradients underline the importance of obtaining optimum plasma conditions for laser action throughout the laser tube length and the difficulty of providing an adequate but still practical return path for the gas in such laser discharge tubes. (M.H.R.)

**44411** HYSTERESIS PHENOMENA DURING THE FLOW OF A CONDUCTING GAS IN AN MHD-ENERGY CONVERTER CHANNEL. **Vulis, L. A.; Dzhaugashtin, K. E. (Leningrad Higher Naval Engineering Coll.). Teplofiz. Vysok. Temp., 4: 59-65 (1966). (In Russian).**

One of the characteristics of MHD flows of a low-temperature plasma is well-defined temperature dependence of conductivity. The nonlinearity due to this may lead to an ambiguity of steady states and to unique hysteresis effects. Inasmuch as the nature of the phenomena investigated, generally speaking, is not related to a specific type of flow, it is natural to assume that an analogous manifestation of nonlinearity is found in cases other than those studied in relation to hypersonic motions. From this viewpoint, an investigation was made of the practically important case of the flow of a conducting gas in an MHD-energy converter channel. The study is made in the framework of a quasi-unidimensional steady-state flow at low values of the magnetic Reynolds number and Hall parameter. The study is restricted to a general, primarily qualitative statement of the problem and some examples which allow the presentation of the final results in a simple form. Detailed data for specific cases may be obtained by means of numerical calculations, unrelated to extensive simplification of the problem. (ATD)

**44412** APPROXIMATE COMPUTATION OF THE VARIATION IN THE ELECTRIC CONDUCTIVITY OF A GAS IN A VORTEX MAGNETOHYDRODYNAMIC FLOW. **Bertinov, A. I.; But, D. A.; Kalugin, V. N.; Vasyukevich, P. V. Teplofiz. Vysok. Temp., 4: 66-72 (1966). (In Russian).**

A majority of articles devoted to the investigation of vortex MHD flow average out gas conductivity and assume it to be constant. It is known, however, that the conductivity of a weakly ionized gas depends on pressure and to a considerable degree on temperature which may vary substantially along the radius during axisymmetric twisting of a conducting gas in an axial magnetic field. An analysis was performed of vortex MHD flow with the assumption that conductivity depends on temperature as a power function. An ideal conducting gas is studied with part of the total enthalpy being converted to electric power. The influence of taking into account the variations of conductivity on the basic parameters of the flow is described. (ATD)

**44413** MAGNETOHYDRODYNAMIC FLOW IN A RECTANGULAR CHANNEL AT HIGH HARTMANN NUMBER. **Drake, David G.; Abu-Sitta, Ali M. (Univ. of Liverpool). Z. Angew. Math. Phys., 17: 519-28 (July 25, 1966).**

The forms taken by Shercliffs' (Proc. Cambridge Phil. Soc., 49: 136 (1953)) exact series solutions for the fluid velocity and magnetic field at high Hartmann number were obtained. It was found that the results agree well with the boundary-layer solution of Shercliff. The mean velocity obtained from the asymptotic form of the velocity agreed with the result derived by Williams (J. Fluid Mech. 16: 262 (1963)). It is shown that the skin-friction on the walls parallel to the imposed magnetic field can be written in a closed form involving tabulated functions, while the expression for the skin-friction on the walls perpendicular to the imposed magnetic field involves an integral. (W.D.M.)

**44414** ON THE STRUCTURE OF ALFVEN SHOCKS. **Turcotte, Donald L. (Cornell Univ., Ithaca, N. Y.); Chu, C. K. Z. Angew. Math. Phys., 17: 528-37 (July 25, 1966).**

The structure of the Alfvén shock in an incompressible fluid with finite electrical conductivity was studied. It is shown that for several incompressible MHD flow problems it is necessary to include Alfvén shocks in order to obtain the correct solution to the boundary or initial value problem. For finite electrical conductivity the Alfvén shock is a dispersive wave with a structure similar to that of a fluid-dynamic boundary layer. For the flow of a highly conducting incompressible fluid over blunt bodies it is expected that shocks will be present provided that the magnetic and flow vectors are not alligned. Since flow discontinuities may occur, the flow field may be entirely different from that of an incompressible fluid with zero electrical conductivity. (W.D.M.)

## Geophysics

*Refer also to abstracts 43547 and 43667.*

**44415** (AD-628320) IDEALISED PROBLEMS CONCERNING THE MOTION OF CYLINDRICAL PLASMA SHEETS IN A MAGNETIC FIELD, WITH APPLICATIONS OF GEOPHYSICAL INTEREST. **Downs, Angela M. (London Univ. (England). Queen Mary Coll.). 1966. Contract AF-EOAR-74-64. 41p. (AFCRL-66-6). CFSTI $2.00 cy, $0.50 mn.**

In a system with radial cylindrical symmetry of cylindrical polar coordinates a cylindrical plasma sheet of infinite electrical conductivity is projected from infinity towards a magnetic field with both axial and toroidal components. An inner, currentbearing plasma sheet, initially in equilibrium, also forms part of the system and influences the motion of the outer plasma sheet. The interaction of the oncoming sheet with this "ring current" is studied and applications are made to problems of geophysical interest. In particular, the shape of the transient hollow formed in the approaching plasma stream is obtained. A different model, in which the inner, current-bearing sheet is fixed and gives rise to a magnetic field which behaves like that due to a dipole at large distances, is also considered. The effect of the ring current is found to be more pronounced in this case. The hollows obtained are compared with that due to Beard (1960) and with recent satellite results, and it is suggested that centrifugal effects should be included in computations of the geomagnetic hollow. (auth)

**44416** (AD-639436) A COMPUTATIONAL MODEL FOR GEOMAGNETICALLY TRAPPED PARTICLE SHELLS AND KINEMATIC PARAMETERS. Roederer, Juan G. (National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center); Herod, James V. (Air Force Weapons Lab., Kirtland AFB, N. Mex.). Sept. 1966. 80p. (AFWL-TR-66-78). CFSTI $3.00 cy, $0.75 mn.

A computer program was constructed which calculates a model for geomagnetically trapped particle shells and the associated kinematic parameters. Included is the calculation of longitude-dependent drift velocities and bounce paths. The methods used in constructing the program as well as the input and output of the code are described. (auth)

**44417** (LA-DC-7837) RESEARCH ACTIVITIES OF THE A.E.C. AIRCRAFT [IN ATMOSPHERIC TESTING]. Peterson, R. W.; Liebenberg, D. H. (Los Alamos Scientific Lab., Univ. of California, N. Mex.); Keith, J. E. (Sandia Corp., Albuquerque, N. Mex.). [1966]. Contract W-7405-eng-36. 37p. (CONF-660445-1). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Symposium on Recent Advances in Cosmic Ray Research, Huntington Beach, Calif.

For the purpose of maintaining the AEC's atmospheric testing capability, three Air Force C-135 aircraft have been assigned to the AEC on a long-term basis. While most of the hours flown by the aircraft are for the requirements of the readiness program, some flight time is available for research on a non-interference basis. The types of experiments which have been done with the aircraft can be divided into three main groups: solar eclipse research, comet studies, and cosmic-ray research. Information on these studies is given. (M.H.R.)

**44418** DETERMINATION OF THE PRODUCTION HEIGHT OF MUONS IN EXTENSIVE AIR SHOWERS ON THE BASIS OF THEIR GEOMAGNETIC DEFLECTION. Somogyi, A. (Univ. of Durham, Eng.). Ann. Physik (7), 17: 221-32(1966). (In German).

Muons in extensive air showers undergo extensive displacements as a result of the geomagnetic field. The size of these displacements depends very strongly on the production heights of the muons. Various theoretical ways are proposed to determine their production height on the basis of the measured spatial distribution and energy distribution of the muons. Practical indications on how the experiments should be carried out and an estimation of the expected accuracy are given. (tr-auth)

**44419** STORM SUDDEN COMMENCEMENT AND INCONSPICUOUS UNIVERSAL TIME VARIATIONS OF THE COSMIC RAY INTENSITY. Sandstroem, Arne Eld; Troncoso, Oscar L. Ark. Geofys., 5: 1-8(1966).

Meson and nucleon component records from three high-latitude stations have been employed in a search for small Forbush decreases. The study comprises sudden commencements and associated decreases during the periods between major cosmic-ray storms between Sept. 1956 and Dec. 1959. The results indicate that, contrary to what has been supposed previously, an associated Forbush decrease can be found for every sudden commencement. The results also concern sudden commencements which were reported by only a limited number of stations. (auth)

**44420** PROMINENT FORBUSH DECREASES AND QUESTIONABLE MAGNETIC DISTURBANCES. Sandstroem, Arne Eld; Troncoso, Oscar L. Ark. Geofys., 5: 9-13(1966).

Ten well-developed Forbush decreases, recorded during 1957-59 were associated with magnetic events not definitely accepted as storm sudden commencements. These decreases do not display any features distinguishing them from other decreases recorded during the same period. (auth)

**44421** INTENSITY RECOVERY AFTER FORBUSH DECREASES. Anda, Ricardo; Oestman, Bo. Ark. Geofys., 5: 15-22(1966).

Several cosmic ray storms of the years 1957 to and including 1963 are treated in this study of the recovery constant after a Forbush decrease. The recovery constant is computed by an exponential curve fitting method as well as by a straight line fitting method. A comparison of the results from the two methods show that any one of them can be used. The results from the computations show that there exist differences in the recovery constants computed from data recorded by separate instruments for some storms during 1957 to and including 1960. A method of dividing Forbush decreases into types by using recovery constants is discussed. (auth)

**44422** DIRECTIONAL DISTRIBUTION OF THE COSMIC-RAY-MESON COMPONENT AND SOLAR ACTIVITY. Stensland, B. Ark. Geofys., 5: 31-44(1966).

The distribution of the cosmic-ray meson component at an altitude of a few hundred meters was studied using an unshielded inclined counting tube telescope at 65°N geomagnetic latitude. The telescope was mounted on a turntable swinging quickly through 180° every 60 minutes. Time plots of the ratio of the southerly to northerly particle influx revealed characteristic disturbances accompanying the sudden commencements of geomagnetic storms associated with decreases of the Forbush type. In 1963 the experiments revealed disturbances of about four days duration, which returned several times with a period of 27¼ days. Between July 1959 and February 1963 an anisotropy was found at 30° zenith angle, the southerly influx exceeding the northerly one by about one percent. Gradually during this period the anisotropy disappeared, and the last measurements in 1963 and 1964 revealed an almost isotropic distribution at small zenith angles. On the other hand, at 45° zenith angle, the northerly influx exceeded the southerly one by a few percent. (auth)

**44423** LATITUDE EFFECT OF THE NEUTRON MULTIPLICITY AS DETECTED BY A SHIPBORNE NEUTRON MONITOR. Dyring, Eric; Sporre, Bert (Univ. of Uppsala). Ark. Geofys., 5: 67-77(1966).

A multiplicity meter was attached to the 2-counter IGY-type neutron monitor mounted on board M/S Stratus, which twice travelled along the route Scandinavia-South Africa-Australia-Suez-Scandinavia during 1964. The threshold rigidity dependence on the intensity of events with different detected multiplicity is studied. A decreasing latitude effect with increasing detected multiplicity is observed and discussed. However, the multiplicities 1 and 2 are found to have equal latitude dependence; in favor of muon contribution to the counting rate of an IGY neutron monitor. By comparing the efficiency of the least square fittings it is shown, that the theoretical threshold rigidities of Kodama improves the fit compared with the Quenby and Wenk threshold rigidities. (auth)

**44424** MULTIPLICITY MEASUREMENTS ON THE UPPSALA IGY-NEUTRON MONITOR. Dyring, Eric; Sporre, Bert (Univ. of Uppsala). Ark. Geofys., 5: 79-85 (1966).

A multiplicity meter was attached to one 6-counter section of the Uppsala IGY-neutron monitor. The attenuation coefficients for different multiplicities were estimated by least square regression on filtered intensity and atmospheric pressure data. The attenuation coefficient is found to be increasing with increasing multiplicity. The total counting rate is studied as a function of dead time and found to be non-exponential, which may be explained by the complex geometry of the IGY-neutron monitor. The multiplicity distributions were studied during the period January 1964-March 1965 giving no significant time variations. During the two small 1-2 percent Forbush decreases during 29-31 Jan. 1964 and 9-11 Feb. 1965, indications of an increasing multiplicity are observed. (auth)

**44425** SOLAR CYCLE VARIATION IN THE ATTENUATION LENGTH OF THE COSMIC RAY NUCLEON COMPONENT. **Dyring, Eric; Lindgren, Stig; Martinelle, Sten (Univ. of Uppsala). Ark. Geophys., 5: 87-90(1966).**

Evidence is presented which strongly supports a decrease in the attenuation length of the nucleonic component with decaying solar activitv. At Uppsala, which is a sea level station with a geomagnetic cutoff of 1.43 Gv/c, a 5% change of the attenuation length is found to take place between 1958-1960 and 1964-1965. Essentially four different methods for the evaluation were used. (auth)

**44426** THE IONOSPHERIC ABSORPTION OF SHORT WAVES DURING THE SOLAR ECLIPSE ON 15 FEBRUARY 1961. IV. FIELD-STRENGTH MEASUREMENTS FROM SHORT-WAVE TRANSMITTERS (A3 METHOD). **Nitzsche, P. (Heinrich-Hertz-Institut fuer Schwingungsforschung, Berlin). Beitr. Geophysik, 73: 266-73(1964). (In German).**

The effect of the solar eclipse on short-wave radio reception was studied at this Institute using signals transmitted from Stuttgart and Norddeich. The eclipse reaches only partial totality in the region in which the results were obtained. The solar eclipse on 15 February 1961 clearly affected obliquely incident radio waves from c-w transmitters (2.614 and 6.030 Mcps, respectively). The relative min of absorption coincided with max eclipse. The enhancement of field intensity at the max eclipse was 14 db and 3.8 db, respectively. This is in good agreement with A1-method measurements. While absorption for waves reflected from the E layer returned to the level of the control days at the end of the eclipse, for waves reflected from the F layer the eclipse effect was apparently extended by ~60 min. (BBB)

**44427** THE IONOSPHERIC ABSORPTION OF SHORT WAVES DURING THE SOLAR ECLIPSE ON 15 FEBRUARY 1961. V. COMPARISON OF THE RESULTS OF THE PULSE-REFLECTION (A1) AND COSMIC NOISE (A2) ABSORPTION MEASUREMENTS. **Taubenheim, J.; Lippert, W. (Heinrich-Hertz-Institut fuer Schwingungsforschung, Berlin). Beitr. Physik, 74: 89-98(1965). (In German).**

A quantitative comparison between the results of pulse reflection (A1) and cosmic noise (A2) absorption measurements during the total solar eclipse of 1961, at 3.86 and 25 Mcps, respectively, allows a separation of the contributions of the lower (D and E) and higher (F) regions of the ionosphere to the solar eclipse effect of cosmic noise absorption. The contribution of the lower regions appears to be smaller, whereas the larger contribution of the F region is surprisingly proportional to the solar eclipse variation of the max electron density of the F2 layer ($N_mF2$). An analogous comparison between total absorption values (without eclipse) shows that more than half the cosmic noise absorption is caused by the upper ionosphere. A systematic error in cosmic noise absorption measurements is suggested, which is caused by neglecting absorption during the night. Roughly correcting this error, an 80% contribution of the F region to total absorption seems possible. Quantitative physical interpretation of such a large contribution is still uncertain. (BBB)

**44428** USE OF TRANSMISSION CURVES TO INTERPRET BACKSCATTERING ECHOS. **Delloue, Jean; Goutelard, Claude (Laboratoire de Physique de l'Exosphere, Orsay, France). Compt. Rend., Ser. B, 263: 256-9 (July 18, 1966). (In French).**

It is shown that the method of transmission curves can be extended to observations of ionospheric backscattering. This method allows one to identify the various modes of propagation and to synthesize the "equivalent" vertical ionograms. (tr-auth)

**44429** MEASUREMENT OF THE OPTICAL PATH VARIATION OF SIGNALS GENERATED BY A LONG WAVE EMITTER AND PROPAGATED IN THE WHISTLING MODE. **Delloue, Jean; Garnier, Michel; Berthoumieu, Henri (Laboratoire de Physique de l'Exosphere, Orsay, France). Compt. Rend., Ser. B, 263: 324-7(July 25, 1966). (In French).**

The variations in the optical paths of gyroelectric echoes were measured and some very feeble modifications of their trajectories as well as of their ionization distribution along this trajectory were determined. (tr-auth)

**44430** THERMAL CONDUCTION AND ION TEMPERATURES IN THE IONOSPHERE. **Banks, Peter M. (Institut d'Aeronomie Spatiale de Belgique, Brussels). Earth Planet. Sci. Lett., 1: 270-5(Sept. 1966).**

An analysis is made of the ion energy balance equations for the ionosphere including the effects of $O^+$, $He^+$, and $H^+$ ions, thermal conduction, and the cooling by atomic hydrogen and helium. It is shown that thermal conduction strongly affects the ion temperature profile for conditions of moderate and low electron densities and that the high altitude ion temperature can be significantly less than the electron temperature. In addition, $H^+$ in concentrations as low as 10% of the total ion density is found to be a major recipient of heat from the ionospheric electron gas and has an important influence upon the total ion energy budget. (auth)

**44431** NOTE ON THE PROPAGATION OF HYDROMAGNETIC WAVES IN THE MAGNETOSPHERE. **Patel, V. L. (Rice Univ., Houston, Tex.). Earth Planet. Sci. Lett., 1: 282-3(Sept. 1966).**

Propagation of hydromagnetic waves detected in the earth's magnetosphere using the magnetic field observations by Explorer 12 and 14 satellites is discussed. It is found that in order to detect these waves in the ground based magnetograms, the longitudes of the satellite and the observatory should not differ more than 15 degrees. The results of this study cannot be explained in the terms of ray tracing calculations because the period is too long. However, evidence of the propagation of the waves traveling across the field lines in the magnetosphere was not found. The waves occur on L shells with very small longitudinal spread. This fact was also observed in recent satellite 1963−38c experiment. (auth)

**44432** SOLAR ECLIPSE MAGNETIC OBSERVATIONS AND Pc-1 GEOMAGNETIC MICROPULSATIONS. **Boyd, G. M. (Univ. of British Columbia, Vancouver, Can.). Earth Planet. Sci. Lett., 1: 333-4(Sept. 1966).**

During the solar eclipse of 20 July 1963, induction micropulsation equipment with rubidium vapor magnetometers was operated at Hay River, N. W. T., and Fort Vermilion, Alberta. The records obtained show a reduction of the Pc-1 signal amplitude during the eclipse. Comparisons made with records from Suffield, Alberta; Northaway, Alaska, and Montreal, Quebec, tend to reinforce this conclusion. The results are described. (M.O.W.)

**44433** F2-LAYER RATES AT SUNSPOT MINIMUM. **Rishbeth, H. (Radio and Space Research Station, Ditton Park, Eng.). J. Atmos. Terrest. Phys., 28: 911-18(Oct. 1966).**

New data are available about quantities which play an important part in the theory of the ionospheric F region: the ion−atom interchange coefficients, ion−neutral diffusion coefficient, and flux of solar ionizing radiation. These data are combined with several published model atmospheres to compute theoretical values of noon peak electron density, $N_mF2$, and the height of the peak, for a fairly low level of solar activity. The results agree with observed values for the midlatitude F2 layer only if a model atmosphere containing a low proportion of molecular gases is adopted. Difficulties are encountered concerning the night F2 layer. (auth)

**44434** LONGITUDINAL DRIFT EFFECTS AND FURTHER ASPECTS OF SUPERIMPOSED ELECTRIC FIELDS. Catchpoole, J. R. (Univ. of Queensland, Brisbane). J. Atmos. Terrest. Phys., 28: 919-32(Oct. 1966).

The longitudinal drift rate of an electron trapped in the Earth's magnetic field is a function of latitude. It is therefore dependent on the limits of the spiralling motion; that is, on the northern and southern co-ordinates at which mirroring occurs. A determination is made of the change in this drift rate which results from a displacement of the spiralling-mirroring domain; the latter itself being a consequence of the superposition of an electric field along the direction of the magnetic field lines. An estimate is made of the relative change in space charge with longitude which is brought about by this dispersion. The net change both from this cause and from displacement loss to the ionosphere is found. In addition, previous calculations which illustrated the extent of the spiralling electron displacement are here supplemented with the corresponding results for protons and heavier ions. The relative importance of the magnetic and electric fields is noted for both cases. (auth)

**44435** ON THE VARIATIONS IN THE RELATIONS OF SOLAR INDICES TO E- AND F-REGION CHARACTER FIGURES. Godoli, G.; Tagliaferri, G. L. (Arcetri Astrophysical Observatory, Florence). J. Atmos. Terrest. Phys., 28: 933-44(Oct. 1966).

The long-term variations in the relations of solar indices to E- and F-region character figures can be simply interpreted by considering the behavior of the solar indices without assuming changes in solar radiation. (auth)

**44436** AN IONOSPHERIC ESTIMATE OF NITRIC OXIDE CONCENTRATION IN THE D REGION. Mitra, A. P. (Pennsylvania State Univ., University Park). J. Atmos. Terrest. Phys., 28: 945-55(Oct. 1966).

It is shown that the dissimilar nature in the solar cycle variations in the three major competing ionizing sources for the D region (e.g. x rays below 8A, $L_\alpha$, and cosmic rays) can be used to provide an estimate for the concentration of the neutral nitric oxide at and near 70 km. Use of the electron density profiles recently given by Deeks (1965) for sunspot minimum and maximum conditions for equinox in middle latitudes give a nitric oxide concentration of $4 \times 10^5/\mathrm{cm}^3$ around 72 km, about one hundredth of Barth's rocket-deduced value. When this value is integrated with currently available photochemical information, the following empirical distribution is indicated: $n(NO) = 2 \times 10^{-2} \exp(-3300/T)\, n(O_2) + 5 \times 10^{-7} n(O)$. (auth)

**44437** THE IONOSPHERIC DISTURBANCE AND ATMOSPHERIC WAVES. I. GENERAL DISCUSSION. King, G. A. M. (Geophysical Observatory, Christchurch, N. Zeal.). J. Atmos. Terrest. Phys., 28: 957-63(Oct. 1966).

An outline is given on how disturbances in the auroral regions can give rise to atmospheric winds which then affect the F region at middle latitudes. Atmospheric waves generated by nonuniform heating in auroral activity travel through the F region. They mix the atmosphere and thus raise the recombination rate for the ionization at considerable horizontal distances from the aurora. The mixing action sets in when the waves, rising through the atmosphere, reach a height where the ambient pressure is no longer large compared with the perturbation. The ionospheric atmosphere can thus be largely in diffusive equilibrium yet at the greater heights be mixed temporarily. Recovery from mixing is by diffusive separation with a time constant that depends on the depth of mixing, and therefore depends on the size of disturbance. The increase in recombination accounts for the most conspicuous features of disturbance at middle latitudes — the depression of $f_0F2$ and the accentuation of the F1 stratification. (auth)

**44438** MAGNETOSPHERIC CURRENTS, ASSOCIATED WITH THE N-S ASYMMETRY OF $S_q$. van Sabben, D. (Royal Netherlands Meteorological Inst., De Bilt). J. Atmos. Terrest. Phys., 28: 965-81(Oct. 1966).

The systematic N-S asymmetry of the magnetic daily variation $S_q$ at the time of the equinox is ascribed to a system of electric currents, passing through the magnetosphere along the magnetic lines of force and closing their circuits in the ionosphere. The magnetic fields of a number of elementary types of these magnetospheric–ionospheric current systems have been computed. A superposition of such elementary fields is determined which gives a good representation of the anti-symmetrical part of $S_q$ on September 21, 1958. The associated current system appears to be concentrated in a longitude sector, centered 27° W of the solar meridian. It is comparable in magnitude with the purely ionospheric current system, associated with the symmetrical part of $S_q$. Inferences are made as to the ionospheric winds that are necessary to produce this current system by dynamo action. The possibility of a non-ionospheric cause is also indicated. (auth)

**44439** ON THE THEORY OF THE INTERACTION OF A SOLAR CORPUSCULAR STREAM WITH THE GEOMAGNETIC FIELD. Dunford, E. (London Univ.). J. Atmos. Terrest. Phys., 28: 1011-21(Oct. 1966).

The motion of a system of coaxial cylindrical plasma sheets, initially projected towards an axial magnetic field, is investigated and applied to the interaction of the solar stream with the geomagnetic field. It is is found that the sheets may or may not overtake each other according to the initial conditions assumed. In either case a disordered region is formed behind the front sheet which is analogous to the turbulent transition region between the magnetospheric boundary and the detached bow shock wave. The currents induced in this turbulent region shield the outer sheets from the axial magnetic field. A further conclusion is that the density of the stream near the boundary is only increased by a factor of three or four due to the compression of the magnetic field. (auth)

**44440** HORIZONTAL DRIFT AND ANISOTROPY IN THE F1 REGION. Sivaram, B. M. (Andhra Univ., Waltair, Ind.). J. Atmos. Terrest. Phys., 28: 1025-6 (Oct. 1966).

The horizontal drift and anisotropy in the F1-region at Waltair were studied during magnetically active and quiet conditions. The anisotropy seems to affect only the drift direction but not the speed. Magnetic activity seems to enhance the anisotropy and alters the drift direction. (auth)

**44441** PROPERTIES OF THE AURORAL-ZONE ELECTRON SOURCE DEDUCED FROM ELECTRON SPECTRUMS AND ANGULAR DISTRIBUTIONS. Mozer, F. S. (Univ. of California, Berkeley); Bruston, P. J. Geophys. Res., 71: 4451-60(Oct. 1, 1966).

Electron fluxes, spectrums, and angular distributions were measured over the energy range of 65 kev to greater than 400 kev on a rocket that was flown along a magnetic field line into the breakup phase of an IBC 1 aurora. Analyses of the data indicate that: (1) the energies and/or pitch angles of all observed electrons, including those with pitch angles of 90°, were probably significantly changed on each bounce owing to nonatmospheric interactions; (2) electron groups with energies above at least 400 kev were observed to be present, to vary independently of lower energy electrons, and to produce differential energy spectrums that were probably double peaked; (3) during quiescent precipitation the angular distribution was independent of energy and was peaked at a pitch angle near 90°. An increase in the precipitating flux was characterized by an increased intensity at all energies and angles, by a softening of the spectrums, and by an angular distribution that became more isotropic with decreasing energy. These features are properties of the electron source or other nonatmospheric process and are not weighted by atmospheric lifetime effects that depend on pitch angle. (auth)

**44442** AURORAL-ZONE PROTON-ELECTRON ANTICORRELATIONS, PROTON ANGULAR DISTRIBUTIONS, AND ELECTRIC FIELDS. Mozer, F. S. (Univ. of California, Berkeley); Bruston, P. J. Geophys. Res., 71: 4461-7(Oct. 1, 1966).

Data obtained on a rocket flown into an aurora show that a proton-electron anticorrelation existed in the sense that a decrease (increase) of the lowest energy proton flux at small pitch angles was accompanied within about one second by an increase (decrease) in the corresponding electron flux. Low-energy protons moving predominately up the magnetic field lines from apparent mirror points well within the atmosphere also show this behavior. The proton-electron anticorrelation and the predominately upward-moving protons are interpreted in terms of an electrostatic field oriented along the magnetic field line. (auth)

**44443** NONSYMMETRIC INFLATION OF A MAGNETIC DIPOLE. **Parker, E. N. (Univ. of Chicago). J. Geophys. Res., 71: 4485-94(Oct. 1, 1966).**

The basic theoretical properties of nonsymmetric inflation of a dipole magnetic field by ionized gas are pointed out. It is shown that the distortion $\Delta B$ of the field in the neighborhood of the dipole depends very much upon whether there is a nonconducting layer present and upon the configuration of the inflating gas, in contrast to symmetric inflation where $\Delta B$ depends only upon the total energy of the inflating gas. Dissipation of the nonsymmetric portion of the inflating gas is rapid because nonsymmetric inflation drives current down along the magnetic lines of force and across the ionosphere. Dissipation is also rapid because of the nonsymmetric distortion of the field, whose pattern rotates with the azimuthal drift of the inflating gas. The high rate of dissipation implies that nonsymmetric inflation can probably be important only during the active phase of a magnetic storm. (auth)

**44444** ASYMMETRIC RING CURRENTS AND THE LOW-LATITUDE DISTURBANCE DAILY VARIATION. **Cummings, W. D. (Rice Univ., Houston, Tex.). J. Geophys. Res., 71: 4495-4503(Oct. 1, 1966).**

An asymmetric ring current belt consisting of a symmetric ring current and a superimposed partial ring current system is proposed as the explanation for the low-latitude disturbance daily variation. The magnetic effects of the partial ring current system are derived using a scale model together with a small magnetometer as an analog computer. The magnetic field of an asymmetric ring current belt is derived by assigning an amplitude A to the partial ring current function and an amplitude S to the (constant) symmetric ring current function. The span in longitude, the initial position in local time, and the local-time drift rate of the partial ring current are also adjustable parameters in the asymmetric ring current model. Recovery phases for stations with various longitudes are derived by assuming exponential decays for the partial ring current and symmetric ring current. Measured and computed recovery phases are compared for a few magnetic storms. The comparisons show that even this very simple model of the asymmetric ring current can account for most of the low-latitude disturbance daily variation in the recovery phase. (auth)

**44445** INFLATION OF THE INNER MAGNETOSPHERE DURING A MAGNETIC STORM. **Cahill, Laurence J. Jr. (Univ. of California, San Diego, La Jolla). Contract NASw-155. J. Geophys. Res., 71: 4505-19(Oct. 1, 1966).**

A great magnetic storm commenced on April 17, 1965. Explorer 26 carried a moving magnetic observatory through the inner magnetosphere, L = 2 to L = 6, many times during the development and recovery of the storm. The main phase was asymmetrical and was apparently caused by the rapid growth of a large body of charged particles in the evening and late afternoon quadrants. The recovery phase was more symmetrical and appears to be due to inflation of the magnetosphere by a belt, centered at L = 3.5 on the equator, of charged particles encircling the earth. The decay time constant of this belt was about 4 days. (auth)

**44446** BEHAVIOR OF TOPSIDE AND BOTTOMSIDE SPREAD F AT EQUATORIAL LATITUDES. **Krishnamurthy, B. V. (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Res., 71: 4527-33(Oct. 1, 1966).**

Using the Alouette 1 topside ionograms for equatorial latitudes for the period from September 1964 to February 1965, the diurnal behavior of topside spread F and its association with magnetic activity was studied. It is found that there is a negative correlation between the occurrence of topside spread F and $K_p$ indices. From a comparison of spread F below $hmF_2$ as observed from the Huancayo bottomside ionograms and the topside spread F at the same latitude, it is found that, besides the general similarity in their diurnal behavior, the onset of spread F is earlier in the bottomside compared to that in the topside and that the phenomenon decays later in the topside than in the bottomside. These results are examined in the light of current theories of spread F, and a qualitative explanation is suggested for the persistence of topside spread F in the morning hours. (auth)

**44447** IONOSPHERIC WINDS MEASURED BY GUN-LAUNCHED PROJECTILES. **Murphy, Charles H. (Ballistic Research Labs., Aberdeen Proving Ground, Md.); Bull, Gerald V.; Edwards, Howard D. J. Geophys. Res., 71: 4535-44(Oct. 1, 1966).**

Project HARP (High Altitude Research Project) is using gun-launched projectiles to probe the upper atmosphere. Under this program, 130-mm projectiles have reached 70 km, and 420-mm projectiles were placed 143 km over Barbados. The first experimental program for the 420-mm gun was the production of luminous TMA trails for the measurement of winds above 90 km. This smoothbore extended gun is 36 meters long, weighs 180 metric tons, and has flown vehicles that generate TMA trails from 90 km to 138 km. In the time period July 1964 to February 1966, forty-nine such nighttime trails have been photographed and twenty-nine of these analyzed. During twenty-two of these flights, concurrent ionosonde records have been taken, and the locations of sporadic-E layers have been determined for comparison with the wind profiles. The wind data analyzed showed little evidence for the Rosenberg suggestion that the wind vector rotates with increasing altitude. Nine direction reversals occurring in less than 3 km were observed, and fourteen layers of constant direction flow with thicknesses greater than 8 km were observed. A maximum wind speed of 147 m/sec was measured. The six trails of the night of September 20–21, 1965, showed a rapid variation of meridional component of wind at fixed altitude with peak-to-peak amplitude of over 200 m/sec. Sine waves were fitted to wind components at fixed altitude with fair-to-good standard deviations. (auth)

**44448** IDENTIFICATION OF ACOUSTIC-GRAVITY WAVE MODES FROM IONOSPHERIC RANGE-TIME OBSERVATIONS. **Wickersham, A. F. Jr. (Stanford Research Inst., Menlo Park, Calif.). J. Geophys. Res., 71: 4551-5(Oct. 1, 1966).**

The nuclear detonation at Novaya Semlya on October 30, 1961, produced a traveling disturbance in the ionosphere that was recorded by ionospheric sounding stations on the European continent. A compilation of the times of occurrence of maximums in perturbation at various stations permits a determination of the propagation speeds of various components of the disturbance. By comparing such data with theory, we find that the disturbances were the acoustic modes, the fundamental, and the second to fifth gravity-wave modes of fully ducted, acoustic-gravity waves. (auth)

**44449** IONOSPHERIC ELECTRON CONTENT AT TEMPERATE LATITUDES DURING THE DECLINING PHASE OF THE SUNSPOT CYCLE. **Yeh, K. C.; Flaherty, B. J. (Univ. of Illinois, Urbana). J. Geophys. Res., 71: 4557-70(Oct. 1, 1966).**

The values of electron content obtained by observations of Faraday effect for the period July 1961 to October 1964 are presented. These values, when combined with values obtained by other workers at a time when the sun was more active, enable us to study the diurnal, seasonal, and sunspot dependence of the electron content and the slab thickness. These experimentally measured quantities are then related to the physical quantities such as the diffusion coefficient and the electron and ion temperatures by using a diffusion transport model. The seasonal dependence of the electron content and the slab thickness are not in agreement. Possible causes of seasonal anomaly are examined in terms of a diffusion transport layer. The most favored mechanism seems to be the change of composition of the minor constituent $O_2$ or $N_2$. The slab thickness is found to increase with increasing magnetic activities. (auth)

**44450** DIURNAL VARIATION OF LARGE-SCALE IONOSPHERIC IRREGULARITIES. **Bhonsle, R. V.** (Stanford Univ., Calif.). **J. Geophys. Res., 71:** 4571-7(Oct. 1, 1966).

The harmonically related radio transmissions at 40 and 360 Mc/s from an ionospheric beacon satellite S-66 (1964-64A/BE-B) monitored at Stanford, California (37.4°N, 237.8°E; geographic), during the period from October 1964 to October 1965, are analyzed by the differential Doppler method to deduce the mean diurnal variation of the large-scale ionospheric irregularities in terms of the average gradient of irregularities expressed in electrons/m$^2$ 100-km horizontal distance. It is shown that the average gradient of the large-scale ionospheric irregularities exhibits a mean diurnal variation that is significantly different, both in amplitude and phase, from that of the columnar electron content of the ionosphere. Under a moderately agitated but steady geomagnetic condition ($K_p \leq 4$), the diurnal variation in the geocentric equatorial range to the "knee" or the plasmapause in the magnetosphere, deduced from whistler studies, seems to be anticorrelated with that of the average gradient of irregularities in the columnar electron content of the ionosphere. A qualitative explanation for the observed anticorrelation is suggested in terms of the possible convection of thermal ionization in the magnetosphere. (auth)

**44451** GEOMAGNETIC SPECTRUM: 40 DAYS TO 5.5 YEARS. **Currie, Robert G.** (Univ. of California, Los Angeles). **J. Geophys. Res., 71:** 4579-98(Oct. 1, 1966).

Mean daily values of magnetic data for 27 observatories were digitized and power spectrums computed; periods greater than 40 days are discussed. The mean amplitudes of the semiannual line are 5.29 $\gamma$ for H and 2.41 $\gamma$ for Z, while the respective values for the annual line are 4.80 $\gamma$ and 4.75 $\gamma$. Amplitude, coherence, and phase observations indicate the lines have fundamentally different generating mechanisms. A ring current origin, probably situated near $3R_E$ is proposed for the semiannual line. Recent observations support an early theory of Vestine that meridional ionospheric winds blowing from the summer toward the winter hemisphere are the origin of the annual line. A previously reported quasi-biennial line has not been found, but evidence suggests the statistical reality of the solar cycle subharmonic. Geomagnetic north (X′) and east (Y′) spectrums have resolved the semiannual and annual Y′ line. The existence of a semiannual Y′ line supports satellite evidence for meridional currents in the magnetosphere. The coherence and phase for the continuum indicate that the entire continuum spectrum from 40 days to 3.7 years is primarily due to storm modulations. (auth)

**44452** A SEARCH FOR SOLAR NEUTRONS NEAR SOLAR MINIMUM. **Bame, S. J.; Asbridge, J. R.** (Los Alamos Scientific Lab., N. Mex.). **J. Geophys. Res., 71:** 4605-16(Oct. 1, 1966). (LA-DC-7973).

Neutron detectors on the Vela satellites have been operating in space at 16−20 $R_E$ since October 17, 1963. An attempt to measure the near-earth intensity of a steady-state solar neutron emission was made by inspection of the neutron detector counting rate records before, during, and after the satellites are eclipsed by the moon or by the earth. The solar flux was too low to be measured; an upper limit of 0.01 neutron cm$^{-2}$ sec$^{-1}$ was determined, assuming a spectrum similar to the terrestrial neutron albedo spectrum. Counting rate records also were inspected for measurable intensities of solar neutron bursts following solar flares, including two importance-3 flares and a number of flares with associated type-IV solar radio noise bursts. No detectable events were found. Neutron bursts with integrated intensities at the earth of $1.5 \times 10^3$ neutrons cm$^{-2}$ could have been detected. The search is continuing as the solar activity rises from solar minimum. (auth)

**44453** BALLOON AND ROCKET OBSERVATIONS OF AURORAL-ZONE MICROBURSTS. **Anderson, K. A.; Chase, L. M.; Hudson, H. S.; Lampton, M.; Milton, D. W.; Parks, G. K.** (Univ. of California, Berkeley). **J. Geophys. Res., 71:** 4617-29(Oct. 1, 1966).

Microbursts have been found to be a common occurrence in the auroral zone. They occur typically in two episodes per day for several days following a geomagnetic storm and for a day or two following strong negative magnetic bays. Microbursts are shown to have a close relationship to the electron precipitation with 5−30-second characteristic times called fast variations. Both now appear to be related to the same underlying plasma wave phenomenon. Microbursts have the same temporal structure at $L = 8$ as they do at $L = 6$. Direct rocket observations show that the electrons involved in this form of precipitation can be fit by an energy spectrum of exponential form with e-folding energy of 20 kev. (auth)

**44454** EXPLORER 12 OBSERVATIONS OF THE TEMPORAL VARIATIONS OF LOW-ENERGY ELECTRON INTENSITIES IN THE OUTER RADIATION ZONE DURING GEOMAGNETIC STORMS. **Frank, L. A.** (State Univ. of Iowa, Iowa City). Contract Nonr-1509(06). **J. Geophys. Res., 71:** 4631-9(Oct. 1, 1966).

Large increases of electron 100 ev $\lesssim E_e \lesssim$ 40 kev energy fluxes over $L \simeq 2.8$ to $L \simeq 4.0$ were observed at the onset of magnetic storms on October 1 and October 29, 1961, with instrumentation on Explorer 12. The omnidirectional energy fluxes at $L = 3.5$ were ~1000 ergs(cm$^2$ sec)$^{-1}$ for these two events, the duration of these events was approximately one day, and the peak energy flux was positioned at $L \simeq 3.0$. The large enhancement of electron 100 ev $\lesssim E_e \lesssim$ 40 kev energy fluxes on October 1 is coincident with large decreases of electron $E_e \gtrsim$ 1.6 Mev intensities and with increases of electron 40 kev $\leq E_e \leq$ 100 kev intensities in the outer radiation zone. Although no spectral information concerning the electron 100 ev $\lesssim E_e \lesssim$ 40 kev fluxes is available, estimates of the decrease of the magnetic field on the surface of the earth at the magnetic equator for monoenergetic electron intensities corresponding to the observed energy fluxes are ~60 $\gamma$ for $E_e$ = 500 ev and ~30 $\gamma$ for $E_e$ = 2 kev during the main phase of the magnetic storm. The observations reported here suggest that these electrons form a ring current centered at ~3 $R_E$, which is responsible for some fraction of the main phase and the rapid-decay component DR1 of magnetic storms. An upper limit on the increases of the proton $E_p \gtrsim$ 400 ev energy fluxes is ~100 ergs(cm$^2$ sec)$^{-1}$ at $L \sim 3$ during the main phases of these two magnetic storms, an upper limit that is not low enough to eliminate a low-energy proton ring current of similar or greater magnitude when compared with the above low-energy electron ring current. (auth)

**44455** OBSERVATIONS OF PROTONS IN THE MAGNETOSPHERE WITH MARINER 4. **Krimigis, S. M.; Armstrong, T. P.** (State Univ. of Iowa, Iowa City). **J. Geophys. Res., 71:** 4641-50(Oct. 1, 1966).

On November 28, 1964, the Mariner 4 spacecraft was launched toward Mars and passed through the outer magnetosphere near the geomagnetic equatorial plane on the dawn side of the earth. The University of Iowa experiment on Mariner 4 consists in part of a thin (~35 microns) surface barrier detector sensitive to protons in the energy ranges $0.50 \leq E_p \leq 11$ Mev ($D_1$) and $0.88 \leq E_p \leq 4$ Mev ($D_2$) and insensitive to electrons of any energy. The maximum proton intensities observed were ~$6 \times 10^7$ (cm$^2$ sec ster)$^{-1}$ in $D_1$ for $2.97 \leq L \leq 3.80$ and $9.3 \times 10^6$ (cm$^2$ sec ster)$^{-1}$ in $D_2$ for $L = 3.14$. The observed counting rates are consistent with a spectrum of the form $dj/dE = KE^{-\gamma}$ with $\gamma$ increasing monotonically from 1.38 at $L \sim 2.35$ to ~8 at $L \sim 6.5$. The counting rates are also consistent with a spectrum of the form $dj/dE = Ke^{-E/E_0}$ with $E_0$ decreasing monotonically from 740 kev at $L \sim 1.88$ to ~100 kev at $L \sim 6.5$. These results represent a new body of measurements of trapped proton intensities near the equatorial plane in the magnetosphere at radial distances $\gtrsim 2.5\ R_E$ and were obtained by a different detection scheme than that employed by Davis and Williamson [1963]. The results are consistent with those of Davis and Williamson. The significance of the observations with respect to proposed theoretical models is discussed. (auth)

**44456** A NEW MEASUREMENT OF THE INTENSITY OF COSMIC-RAY IONIZATION AT SEA LEVEL. **Shamos, M. H.; Liboff, A. R. (New York Univ.). J. Geophys. Res., 71: 4651-9(Oct. 1, 1966).**

Using a new type of ion chamber, featuring a technique that discriminates against residual wall currents, and a thin plexiglas wall, cosmic-ray ionization measurements were made at ambient pressures ranging approximately from 71 to 77 cm Hg. A least-squares interpolation at sea level yields an ionization density of (2.18 ± 0.05) I. (I corresponds to one ion pair per second per $cm^3$ of NTP air.) The variation with pressure is found to be $-3.96\%$/cm Hg, which compares favorably with the published values of the cosmic-ray barometer coefficient. (auth)

**44457** EVALUATION AND DEMONSTRATION OF THE USE OF RETARDING POTENTIAL ANALYZERS FOR MEASURING SEVERAL IONOSPHERIC QUANTITIES. **Knudsen, W. C. (Lockheed Aircraft Corp., Palo Alto, Calif.). J. Geophys. Res., 71: 4669-78(Oct. 1, 1966).**

The use of a plane-gridded retarding potential analyzer (planar ion trap) for measuring dominant constituent ion concentrations, ion temperature, and instrument potential in planetary ionospheres is analyzed. An example of its use for measuring these quantities in the earth's ionosphere is presented. Limitations on the resolution of the instrument for measurement of constituent ion concentrations are considered. Errors in ion temperature that may arise from nonuniformity of the analyzing grid potential, curvature of the ion sheath, and neglect of minor ionic concentrations are evaluated in some detail. (auth)

**44458** THE COMPOSITION AND ENERGY SPECTRUM OF LOW-ENERGY HEAVY NUCLEI OF THE PRIMARY COSMIC RAYS IN JUNE 1963. **Anand, K. C. (Tata Inst. of Fundamental Research, Bombay); Biswas, S.; Lavakare, P. J.; Ramadurai, S.; Sreenivasan, N.; Bhatia, V. S.; Chohan, V. S.; Pabbi, S. D. J. Geophys. Res., 71: 4687-91 (Oct. 1, 1966).**

Final results on the flux and energy spectrum of heavy nuclei of primary cosmic radiation measured in June 1963, are presented, and a short review of other investigations is included. Two nuclear emulsion stacks were flown in balloon flights from Fort Churchill, Canada; one stack was exposed at a mean atmospheric depth of 3.1 g $cm^{-2}$ for 11.2 hours, and the other was exposed at 4.3 g $cm^{-2}$ for 11.1 hours. The heavy nuclei were grouped in the conventional manner. The differential fluxes at the top of the atmosphere of L and M nuclei in the energy interval 150 to 575 Mev/nucleon are plotted, and differential energy spectra of H nuclei together with other measurements made during this period are shown. The L/M, L/S, and H/M ratios measured at flight altitudes and their extrapolated values at the top of the atmosphere are tabulated, and fluxes of the nuclei and their relative abundances are shown. (J.H.M.)

**44459** IONOSPHERIC RAREFACTION FOLLOWING ROCKET TRANSIT. **Felker, J. K.; Roberts, W. T. (George C. Marshall Space Flight Center, Huntsville, Ala.). J. Geophys. Res., 71: 4692-4(Oct. 1, 1966).**

Previous evidence indicates that a powered-rocket flight through the F region of the ionosphere produces a hole which persists up to the order of 1 hr. Evaluation of electron number-density data derived from ionosonde records made at Cape Kennedy and the down-range stations at Grand Bahama Island and San Salvador suggests a decrease in electron number density following the passage of powered rockets through the ionosphere. Locations of sounding stations are shown, and a flight profile depicting rocket-stage separation is included. Ionospheric electron number-density contours are plotted for each station. (J.H.M.)

**44460** MOTION OF CHARGED PARTICLES IN THE VICINITY OF THE NEUTRAL POINT. **Ershkovich, A. I.; Pletnev, V. D.; Skuridin, G. A. Kosm. Issled., 4: 378-93(May-June 1966). (In Russian).**

The motion of charged particles in the vicinity of neutral points is discussed, using two- and three-dimensional models. The neutral point is shown to be a regular singularity in the magnetic field and exists on the boundaries of the magnetosphere where the solar wind interacts with the geomagnetic field. Two types of fields are considered: $H_x = -2Ax$, $H_y = -2Ay$, $H_z = 4Az$, and $H_x = -2Ax$; $H_y = 0$, $H_z = 2Az$. The orbits of charged particles are calculated first in the two-dimensional field where exact solutions are obtained for several special cases. The three-dimensional case is analyzed by using the Volosov recurrence method. (ATD)

**44461** CHARGED PARTICLE MOTION STUDY IN A DIPOLE MAGNETIC FIELD IN AN EXTERNAL MAGNETIC FIELD, BY THE STOERMER METHOD. II. **Shalimov, V. P.; Shvachunov, K. N. Kosm. Issled., 4: 394-403(May-June 1966). (In Russian).**

The results of Part I (Kosmich. Issled., 4: No. 2, 208, 1966) were used to study charged particle orbits emanating from the sun and entering the G-zone of the terrestrial magnetosphere. Inside this region the magnetic field potential is approximated by the sum of a dipole field and a homogeneous field, or $U = U_0 + U_1 = -(M_0/r^2)\sin\varphi - (M_1/r_0^3)\ r\sin\varphi$. Using Equation 15 of Part I, the various boundaries delineating the forbidden and allowed zones for particle trajectories are evaluated. First, the case of periodic trajectories is considered, corresponding to proton energies $E_p \geq 730$ Mev at $r_0 = 10a$ and $E_p \geq 2.9$ Bev at $r_0 = 6a$ (a = earth's radius, and $r_0$ = distance to the magnetosphere boundary along the earth-sun line). The permitted or forbidden zones are calculated for various values of $\alpha = (M_1/2M_0)\ r_0^{-3} = (0.66/r_0^3)$ and $\gamma_1$, and the results are shown graphically. Next, the trajectories are considered for $\alpha > 0.1924$. Similar permitted and forbidden zones are calculated, and the penetration depth is estimated for these particles inside the G-zone. It is shown that decreasing the particle energy decreases its penetration depth inside the G-zone. The threshold energy depends on the ratio of the homogeneous magnetic field strength to the magnetic dipole moment, as well as on the distance up to the magnetosphere boundary. (ATD)

**44462** VARIATION IN THE IONIC COMPOSITION OF THE ATMOSPHERE AT ALTITUDES OF 100 TO 200 KM. **Ivanov-Kholodnyi, G. S.; Danilov, A. D. Kosm. Issled., 4: 439-52(May-June 1966). (In Russian).**

A detailed investigation was made of the changes in the electron and ion concentration in the upper atmosphere as a function of solar radiation and changes in the atmospheric conditions. A total of 11 chemical reactions is considered for the generation of four ionic species and electrons. Fourteen experimental studies are analyzed and presented for an altitude range 100 to 200 km. These results show that over a latitude change from 90° to 55° the relative concentration of the $O^+/n_e$ ion increases but the molecular ions $NO^+$ and $O_2^+$ decrease during lower solar activity. The ratio of the concentration $NO^+/O_2^+$ remains constant, but with variations in the data by a factor of 1.5 in the altitude range 140 to 200 km. Although the concentration of the electrons varies significantly during a solar cycle, at altitudes of 160 to 200 km the $O^+$ concentration is independent of the solar activity. Comparing theoretical and experimental results, the following values are given for the rate constants $\gamma_{NO^+}/\alpha_{NO^+} \approx 4\cdot 10^{-5}$, $\gamma_{O_2^+}/\alpha_{O_2^+} \approx 2\cdot 10^{-4}$, corresponding to a temperature of 1000°K. (ATD)

**44463** DIRECT MEASUREMENTS OF THE CONCENTRATION OF IONS AND ELECTRONS IN THE STRATOSPHERE AND MESOSPHERE. **Bragin, Yu. A. Kosm. Issled., 4: 453-6(May-June 1966). (In Russian).**

Measurements of the concentration of ions and electrons in the atmosphere below 80 km are discussed. The measurements were made with three rocket probes from a research ship in the Pacific Ocean during the second quarter of 1965. The detectors for measuring the total concentration of charged particles, and the electron concentration are described. The concentration of charged particles of one sign in mid-latitudes at 23 h local time is given. This differs from previously obtained data by the absence of local extrema. The concentrations of ions near the equator at 14 h 30 m and 22 h local time are given. The ratio of electron concentration to ion concentration increased from 30% at 71 km to 90% at 75 km. (ATD)

**44464** EVALUATION OF THE COEFFICIENT OF DISSOCIATIVE RECOMBINATION IN THE LOWER IONOSPHERE. **Kozlov, S. I.; Raizer, Yu. P. Kosm. Issled., 4: 574-80(July-Aug. 1966). (In Russian).**

The coefficient of dissociative recombination at altitudes up to ~100 km is calculated using Western rheometer data on ionospheric absorption obtained during the high-altitude nuclear explosion of July 9, 1962. The calculations performed differ from those of R. E. Le Levier in that the important process of ionization of the atmosphere by $\gamma$-radiation of fission products is taken into account. It is shown that at altitudes up to ~100 km, the coefficients of dissociative recombination should be within the limits of $\sim 5.5-8 \times 10^{-7}$ cm$^3$/sec. (ATD)

**44465** THERMOSPHERIC ENERGETICS AND A POSSIBLE EXPLANATION OF SOME OBSERVATIONS OF GEOMAGNETIC DISTURBANCES AND RADIO AURORAE. **Newell, Reginald E. (Massachusetts Inst. of Tech., Cambridge). Nature, 211: 700-3(Aug. 13, 1966).**

The atmosphere is pictured as a series of superposed and interconnected heat engines and refrigerators. An additional hypothesis made is that changes in the thermospheric temperature and wind structure can be brought about by absorption of energy supplied from below. These are discussed in relation to available data and observations on geomagnetic disturbances and auroral phenomena. (M.H.R.)

**44466** SOME FEATURES OF GEOMAGNETIC SUDDEN COMMENCEMENTS FOLLOWING COSMIC-RAY FLARES. **Bhargava, B. N.; Subrahmanyan, R. V. (Astrophysical Observatory, Kodaikanal, India). Planet. Space Sci., 14: 871-89(Sept. 1966).**

The amplitudes of geomagnetic sudden commencements (SC) are examined in relation to the optical, energetic particle, and radio characteristics of source flares. It is shown that all sudden commencements of amplitude above a threshold minimum at a given middle latitude station are associated with energetic particle events. East-west asymmetry and center-limb variation in propagation times of storm plasma are also examined. The daytime enhancement of SC amplitudes in the equatorial regions is briefly discussed. The SC amplitude characteristics are utilized to identify about 50 solar proton events during sunspot cycles 12–18. (auth)

**44467** THE IMPORTANCE OF PHOTOIONIZATION IN THE PRODUCTION OF THE DAYTIME F-REGION AT HIGH LATITUDES DURING WINTER. **Thomas, Lance (Inst. for Telecommunication Services and Aeronomy, Boulder, Colo.). Planet. Space Sci., 14: 891-9(Sept. 1966).**

Solutions of the continuity equation for steady state conditions using reasonable values of photoionization, electron loss, and diffusion rates indicated that photoionization can contribute a large part to F-region ionization at high latitudes in winter at sunspot maximum and might also be important at sunspot minimum. Most of the computations refer to an isothermal atmosphere in which thermal equilibrium exists between the neutral gas, electrons, and ions. It was found, however, that the results are not altered significantly when account is taken of possible differences in temperature between the neutral gas, electrons, and ions unless the electron loss rate is dependent on the electron or ion temperatures. For large solar zenith angles, when electron production occurs at great heights, the F-layer is formed at a fixed height and assumes a constant shape, while its magnitude depends only on the height integral of the electron production and not on its form. These properties also apply when F2-ionization is produced at great heights by low-energy ionizing particles. (auth)

**44468** MAGNETIC FIELD VARIATIONS IN TEMPERATE ZONE SPORADIC-E LAYERS. **Axford, W. I.; Cunnold, D. M.; Gleeson, L. J. (Cornell Univ., Ithaca, N. Y.). Planet. Space Sci., 14: 909-19(Sept. 1966).**

The wind-shear theory of formation of temperate zone ionospheric sporadic-E layers was extended to allow several species of positive ions to be present. The equations developed are used to determine the magnetic field variation within the layer. It is found that a minimum in magnetic field intensity is closely associated with a peak in electron density. An observation of this correlation would provide the best test of the wind-shear theory currently available. Calculations indicate that the expected variations in magnetic field strength are of the order of a few gammas and thus measurable by presently available techniques. Simultaneous measurement of the neutral wind velocity components enables some information about the electric fields to be deduced. (auth)

**44469** GROUP PROPAGATION IN THE WHISTLER-HYDROMAGNETIC EXTENSION OF MAGNETOIONIC THEORY. **Kantor, Gideon; Pivarunas, Frank (Air Force Cambridge Research Labs., Hanscom Field, Mass.). Radio Sci., 1: 1093-9(Sept. 1966).**

An exact formulation of the propagation of wave packets at whistler and hydromagnetic frequencies in a collision-free, electrically neutral mixture of electrons and ions of one type is presented. Simple expressions are derived for $\mu'$, the group refractive index, and for $\alpha$, the angle between the direction of propagation of a wave packet and the wave normal; $\mu'$ and $\alpha$ are explicit functions of X, Y, $\theta$, the magnetoionic symbols, and R, the electron-to-ion mass ratio. Computed values of $\mu'$ and $\alpha$ for both a wave frequency f slightly above the proton gyrofrequency $fM_i$ [$Y = (fM_i/f)(1/R) = 1500$] and somewhat below it ($Y = 10^4$) are plotted as a function of X for particular $\theta$ values; the $\mu'$ and $\alpha$ curves show how magnetoionic theory is modified at low frequencies by including proton motion. Group-ray refractive index surfaces for the large X values which are applicable to whistler and hydromagnetic wave propagation in the magnetosphere are also presented. (auth)

**44470** SPORADIC E AT NIGHT. **Whitehead, J. D. (Univ. of Queensland, Brisbane). Radio Sci., 1: 1111-12 (Sept. 1966).**

It is estimated that intensity of the E region source of ionization at night is required to be 0.1 percent to 1 percent of the intensity during daytime to allow the formation of sporadic E at night. Possible sources are considered. (auth)

**44471** ACCELERATION OF PLASMA CLOUD PRODUCING GEOMAGNETIC STORM AND ORIGIN OF FLARE PHENOMENA. **Kawabata, Kin-aki (Tokyo Univ.). Rep. Ionosphere Space Res. Jap., 20: 107-17(1966).**

If turbulences with velocities of about 30 km/sec are generated near a neutral point in the chromospheric region, a magnetically isolated cloud will be produced in the upper solar atmosphere. The magnetic cloud is squeezed out from the sunspot region due to an inhomogeneity in the sunspot magnetic field. The ejection of the cloud may produce a collapse of the coronal condensation. The collapse may be responsible for x-ray emission, and microwave impulsive bursts. When the size of the cloud is comparable with the scale height or larger, the cloud can escape from the sun without significant loss of energy, and produces a geomagnetic storm. A collision-free shock ahead of the cloud may be responsible for type IV bursts. When the size of the cloud is small, its velocity decreases due to an irreversible process at the shock as the velocity of the Alfvén wave decreases. In such a case, geomagnetic storms and solar events caused by the shock may not occur. (auth)

**44472** INITIAL PHASE OF POLAR CAP ABSORPTIONS ANALYZED BY USE OF CORRECTED GEOMAGNETIC COORDINATES AND COMPOSITIONS OF SOLAR COSMIC RADIATION. Hakura, Yukio (Radio Research Labs., Tokyo). Rep. Ionosphere Space Res. Jap., 20: 128-49(1966).

The onset patterns of PCA relating to solar sub-cosmic radiation are analyzed by the use of "corrected geomagnetic coordinates." It is clarified that the initial phase of the PCA consists of at least three characteristic stages which occur successively in different zones of the polar region: the first stage observed as a slightly enhanced ionization near the geomagnetic pole, the second stage as a sudden development of PCA in the upper auroral zone, and the third in which the enhanced ionization develops gradually in the lower auroral zone to achieve a condition called whole polar cap blackout. Throughout the first and second stages, solar protons are shown to be the sole ionizing radiation, so that the development patterns of PCA in these stages illustrate the invasion process of the solar protons into the earth's upper atmosphere. On the other hand, the $\alpha$ particles in solar cosmic radiation play an important role in the formation of a lower border of the absorption area during the third stage of the PCA initial phase. There are a few exceptional cases called "pure solar proton events," in which the observed flux of solar $\alpha$ particles is too low to produce a PCA effects. (auth)

**44473** NIGHT-TIME ABNORMAL ENHANCEMENT OF IONOSPHERIC F2 REGION ELECTRON DENSITY IN LOW AND EQUATORIAL LATITUDES. Sato, Teruo (Japan Defence Agency, Tokyo). Rep. Ionosphere Space Res. Jap., 20: 150-70(1966).

Anomalous enhancement of the ionospheric F2 region electron density at postsunset time in low and equatorial latitudes is analyzed, and its cause is studied. Data used here are those in American Zone. The major maximum of the electron density enhancement occurs usually at 20 to 24 LT with different times at various latitudes, and generally one or two minor maxima appear between 00 and 04 h. The enhancement phenomenon takes place most remarkably at 16° to 17° geomagnetic latitudes (dip angle 33° to 35°) throughout a year. The boundary latitude that the enhancement can be recorded is lower in winter (about 20°) than in other seasons. Successive time variations of the $f_0F2$ latitudinal distribution or the vertical profile of the F2-region electron density distribution between Huancayo and Washington show that the anomalous high density region (so-called equatorial anomaly maximum located at 15° to 20° in the daytime) moves towards the equator after sunset, and the arrival time at any particular latitude is approximately coincident with the time of the night-time increase of the electron density at that latitude. The direction of the drift of the ionization, deduced from the geomagnetic variation, is downwards and towards the equator horizontally in low and equatorial latitudes during the time concerned, and the magnitudes of drift velocities vary with latitude. The abnormal increase of the F2-region electron density in these latitudes seems to be explained by the combined effect of the drift motion of electron mass and accompanied compression of the mass due to the nonuniformity of the velocity. (auth)

**44474** IONIZATION AND EXCITATION BY PRECIPITATING ELECTRONS. Kamiyama, Hiroshi (Environmental Science Services Administration, Boulder, Colo.). Rep. Ionosphere Space Res. Jap., 20: 171-87 (1966).

The variation in the energy of an energetic electron precipitating into the atmosphere is calculated as a function of initial energy, pitch angle, and altitude, with neglecting the scattering effect. After the energy is reduced to 400 ev, the electron fluxes at various fixed energies are shown as a function of pitch angle and altitude. It is seen that the energy carried by electrons with initial energies exceeding 5 kev is mainly absorbed in the atmospheric region between 90 and 150 km, while electrons with initial energies less than 1 kev release most of their energy in the region above 150 km. For the electron flux of $5 \times 10^6$ $(cm^2 \cdot sec \cdot ster)^{-1}$, with the energy spectrum observed at 1000 km, the maximum production rate of secondary electrons due to impact ionization is estimated to be $2.2 \times 10^2$ $cm^{-3} \cdot sec^{-1}$ at the altitude of 115 km. This leads to a maximum electron density of about $2 \times 10^5$ $cm^{-3}$ at 120 km, and the auroral emissions of about 60 rayleighs at λ5577, 170 rayleighs at λ6300, and 40 rayleighs at λ3914. For this very weak flux, the production rate of secondary electrons at 300 km is estimated to be 4 $cm^{-3} \cdot sec^{-1}$, which could contribute an electron density of the order of $10^4$ $cm^{-3}$ in the F2 region. (auth)

**44475** ANISOTROPY OF COSMIC RAYS IN THE DIRECTION PARALLEL TO THE ROTATION AXIS OF THE EARTH. Murakami, Kazuaki; Kudo, Shoko (Inst. of Physical and Chemical Research, Tokyo). Rep. Ionosphere Space Res. Jap., 20: 188-98(1966).

The anisotropy of cosmic rays in a N-S direction was sought with comparison of intensity variations observed in the Arctic and the Antarctic regions. Three cases of this kind of anisotropy obtained during the IGY show the following features: (1) the intensity of nucleonic component obviously increased in the Arctic (or the Antarctic) region, while no increase was observed in the opposite polar region, (2) no other distinct increase of neutron or meson intensity was detected anywhere, (3) the increment observed in a polar region is of a few percent of total counts and the duration is about half a day, and (4) the spectrum is not steep compared with that of unusual increase and seems somewhat different from that of cosmic-ray diurnal variation. For these cases, no remarkable event occurred on the sun or the earth. The occurrence of this anisotropy is discussed in relation to cosmic ray diurnal variation and also to structure in the interplanetary medium. (auth)

**44476** MEASUREMENT OF IONOSPHERIC ELECTRON DENSITY BY A GYRO-PLASMA PROBE: A ROCKET EXPERIMENT BY A NEW IMPEDANCE PROBE. Oya, Hiroshi; Obayashi, Tatsuzo (Kyoto Univ.). Rep. Ionosphere Space Res. Jap., 20: 199-213(1966).

A new impedance probe experiment was performed by using the K-9M-13 rocket launched at 1210 JST on July 27, 1965 from the Kagoshima Space Flight Center. Two spheres of radius 20 mm were extended into the ionospheric plasma, symmetrically from the rocket body being sustained by thin, electrically short, whips of length 500 mm. The impedance of these probe systems was measured in the frequency range 0.5 Mc to 16 Mc and swept continuously at 1.08 cps. From a series of data which show hybrid resonance, an accurate electron density profile of the ionosphere is evaluated for the flight between 80 and 317 km. (auth)

**44477** MAGNETIC STORMS AND ASSOCIATED PHENOMENA. Cole, K. D. (Univ. of Colorado, Boulder). Space Sci. Rev., 5: 699-770(Sept. 1966).

Two broad conditions of the magnetosphere are discussed, the quiet and the disturbed. During the quiet condition, the polar cap F region either glows red or is filled with a family of red auroral arcs parallel roughly to L contours. Auroras near the auroral zone have an increasing amount of green (λ5577) coloration. The ionospheric F region exists even in winter over the polar caps despite the absence of solar ionizing radiation or obvious corpuscular bombardment. The red polar glow and the maintenance of the quiet polar winter F region are suggested to be accounted for by the cooling of plasma in the geomagnetic tail. These phenomena consume less than 0.01 of the energy and flux of the solar wind impinging on the magnetosphere. The relevance of dynamo theory to this "quiet" condition is discussed. During the disturbed condition, many phenomena such as polar magnetic substorms, auroral substorms, the sudden appearance of "islands" of energetic particles in the magnetosphere, and the rapid acceleration of auroral particles appear to call for the operation of an instability deep in the magnetosphere. The energetics of various facets of geomagnetic disturbance are discussed, and joule dissipation of ionospheric current is found to be a major sink of energy during storms. This causes significant heating of the ionosphere particularly at the site of auroral electrojets. Corpuscular bombardment may consume as much energy, but its heating effect is likely to be less. The stable auroral red arc (SAR-arc) observed equatorwards of normal active aurora during magnetic storms is a major sink of energy of a magnetospheric ring current. It is contended that the ring current generally consists of particles of energy of less than a few kev. It is suggested that the ring current is caused by the irreversible pumping and energization of plasma from the outer to the inner magnetosphere. This pumping is achieved by the random electrostatic fields associated with the noisy component of geomagnetic disturbance. The SAR-arc must be a major feature of ring current theory. The consumption of energy in polar magnetic and auroral substorms, during a complete storm, is tentatively concluded to be far greater than that of the ring current. The ring current is considered to be a byproduct of magnetic disturbance on higher L shells. The main phase of a storm should be considered, in storm analysis, as a separate entity from the initial phase, for physically they bear a tenuous and unpredictable relationship to one another. A new system of analysis is proposed in which the onset of geomagnetic noise rather than sudden commencement is taken as the origin of time, both for magnetic and ionospheric storms. This will enable analysis of storms with both gradual and sudden commencements to be made on a common basis. No reliable evidence is found to support the contention that magnetic storms are caused dominantly by neutral H-atoms ejected from the sun. In fact much evidence can be amassed to deny this hypothesis. (auth)

**44478** IONOSPHERIC ABSORPTION OF COSMIC RADIO NOISE. **Hultqvist, Bengt (Kiruna Geophysical Observatory, Sweden). Space Sci. Rev., 5: 771-817 (Sept. 1966).**

The development of the field of study of ionospheric absorption of cosmic radio noise since 1962 is reviewed. Contributions to the basic theory and methods of analysis are dealt with. Measuring techniques are briefly treated. The development of knowledge of sudden cosmic noise absorption, polar cap absorption, and auroral absorption is reviewed. The emphasis is on the ionospheric effects. The solar disturbances associated with the absorption effects, the propagation of particles from the Sun to the Earth, and other extraterrestrial sides of the story are not treated. (auth)

**44479** THE ABSORPTION EFFECT OF THE AMERICAN NUCLEAR EXPLOSION OF 9 JULY 1962 ON THE HF LINE AT NORDDEICH-NEUSTRELITZ. Nitzsche, P. (Heinrich-Hertz-Institut, Berlin). Z. Meteorol., 18: 384-8(1966). **(In German).**

A Moegel-Dellinger effect was recorded at the DAN transmitter at Norddeich on 9 July 1962, beginning at UT 09.05, max at 09.27, duration 70 min. A SEA effect was observed at Kuehlungsborn, a LW effect at Darmstadt, a SID effect at Lindau, and a D-layer effect at Kiruna and Prague. There was no solar activity reported anywhere; but explosion Starfish occurred at Johnson Island at 09.00. The reflection point of the HF line at Norddeich lies 190° east of the detonation meridian. Daily absorption plotted every 15 min for 9 July and compared with data for the 10 neighboring days show a Starfish effect of 25 db additional absorption. The first electrons recorded must have had kinetic energy of 3.6 Mev (09.05) or 3.0 Mev (09.06). The intensity at 09.27 corresponds to 0.53-Mev electrons. This appears to have been caused entirely by nuclear fission electrons. A wavelike pattern appearing in the registration afterwards is not explained. (BBB)

## Gravitation, Quantum Mechanics, and Relativity Theory

*Refer also to abstracts 44361 and 44401.*

**44480** (IS-T-95) SPIN-ONE PARTICLE IN AN EXTERNAL ELECTROMAGNETIC FIELD. Shay, Dennis (Ames Lab., Iowa State Univ. of Science and Tech.). Aug. 1966. Contract W-7405-eng-82. 54p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Thesis.

A single, manifestly covariant wave equation which describes a spin-one particle with anomalous magnetic dipole and anomalous electric quadrupole moments moving in an external electromagnetic field is given. In the free particle limit this equation reduces to the covariant Weinberg equations. This particle has mass m, charge e, intrinsic magnetic dipole moment $-e\hbar/4mc$, and intrinsic electric quadrupole moment $e\hbar^2/8m^2c^2$. These two moments correspond to a g factor of $\frac{1}{2}$ and a Q factor of $-\frac{1}{2}$. The wavefunction forms a basis for the $(1,0) \otimes (0,1)$ irreducible representation of the Lorentz group. The wave equation has the correct transformation properties under Lorentz transformations, space and time inversion, and charge conjugation. An invariant integral is defined, and from this follows an expression for the matrix element of an arbitrary operator and the time derivative of the matrix element. A method of including external fields in the Bargmann-Wigner equations for spin-one is also given. The resulting equation is essentially the Kemmer equation with fields. (auth)

**44481** APPROXIMATE SOLUTION TO FIELD EQUATIONS OF TWO RELATIVISTIC MODELS OF SPIN PARTICLES. Borelowski, Z. (Jagellonian Univ., Krakow). Acta Phys. Pol., 30: 21-38(July 1966).

Field equations obtained by a method usually applied in the general theory of relativity for the single-point and two-point models of a spin particle are described. In the single-point model the particle is represented by point singularity of a Lagrangian $L_1$ containing higher derivatives $L_1 = -m_0c\,[\sqrt{g_{\mu\nu}u^\mu u^\nu} - (l^2/c^3)\,g_{\mu\nu}\omega^\mu\omega^\nu]$ where $m_0$ is the rest mass of the particle, c is the velocity of light, $u^\nu$ is the four-velocity and $\omega^\nu$ is the four-acceleration of the particle, $g_{\mu\nu}$ are the gravitational potentials of the field in which the particle is found, l is a constant of length dimensions which represents the particle's diffluence and spin, of the order of the Compton wavelength of that particle. In the two-point model the particle is represented by a set of point singularities with four-velocity $u^\lambda$ and a space-like four-vector $r^\lambda$ such that $r_\lambda r^\lambda = -l^2 =$ constant. The Lagrangian of this model is of the form $L_2 = -m_0c\,(\sqrt{g_{\nu\lambda}u^\nu u^\lambda} + \sqrt{-g_{\nu\lambda}\dot{r}^\nu\dot{r}^\lambda} + \Lambda r_\lambda r^\lambda$, where $\dot{r}^\lambda \overset{\mathrm{df}}{=} \times u^\nu\Delta_\nu r^\lambda$ and $\Delta_\nu$ is the symbol connoting covariant derivation, $\Lambda$ is the Lagrange indeterminate factor. The equations of motion and field obtained for these models by virture of the variational principles $\delta\int(R + KL_1)\sqrt{-g}\,d^4x = 0$ and $\delta\int(R + KL_2)\sqrt{-g}\,d^4x = 0$ (R is the curvature scalar), indicate that the "density of inert mass" is different from the "density of gravitational mass" and that this difference vanishes when one puts $l = 0$. Considering the case of a weak field produced by the particles represented by these models, all terms nonlinear with respect to the gravitational potentials and their derivatives, and those terms which are multiplied by the constant are omitted in the field equations. Thus, it is found that although the metric of the space surrounding an isolated spin particle differs somewhat with each model (even though the preferred direction of the particle's spin is equally distinct for each model), the losses in the particle's energy (per second of time) caused by its generation of a field, computed with the use of the particular metric, are of the same magnitude for each of these models. (auth)

**44482** THE NATURE OF THE LORENTZ-INVARIANTS. Chylinski, Z. (Inst. of Nuclear Research, Krakow). Acta Phys. Pol., 30: 293-321(Aug. 1966).

An attempt is made to show that any theory based on the directly observable continuum of events, as in the Theory of Relativity, is too scanty to account for the physical nature of all Lorentz-invariant quantities. In particular the rest-masses of isolated systems (particles) are in our picture among the invariants whose nature cannot be understood within the Lorentz geometry. The geometrical frame work proposed here is thus based on the directly unobservable variables, and as they are canonical variables, we call the corresponding geometry the Phase geometry. The continuum of events (t,x) ceases to be an ultimate physical continuum, and it becomes analyzable in terms of the Phase geometry variables. The relationship between the "directly observable" events and the Phase geometry coordinates is established by means of the Lorentz momentum-invariants only. (auth)

**44483** THE TWO-BODY PROBLEM IN EINSTEIN-MAXWELL THEORY. Eisenstaedt, Jean (Institut Henri Poincare, Paris). Compt. Rend., Ser. A, 263: 149-52 (July 18, 1966). (In French).

An exact and universal method that allows calculation of the structure of the space induced by a small mass, m, while undergoing radial displacement in the field of a mass, M, having a charge, $\epsilon$, is developed from the relativistic Einstein-Maxwell equations $S_{\mu\nu} = \chi\ (M_{\mu\nu} + \tau_{\mu\nu})$. (G.O.Y.)

**44484** ON THE SPECTRA OF SCHROEDINGER MULTIPARTICLE HAMILTONIANS. Hunziker, Walter (Eidgenoessische Technische Hochschule, Zurich). Helv. Phys. Acta, 39: 451-62(Aug. 15, 1966).

For two-body potentials which are locally square-integrable and vanish (arbitrarily slowly) at infinity, the spectrum of the N-particle hamiltonian in the center-of-mass frame is shown to have the form which is commonly expected: it consists of a continuum $\sigma_c$ (generated by states in which the system is broken up into independent parts, and characterized, therefore, in terms of the hamiltonians of these parts), and, in the complement of $\sigma_c$, of eigenvalues only, which are of finite multiplicity and can accumulate at most at the lower end of $\sigma_c$. Some properties of the corresponding bound-state wave-functions are derived, and a problem is posed concerning the generalization of Faddeev's equations to $N > 3$. (auth)

**44485** DOPPLER MEASUREMENT OF SPACE-TIME CURVATURE. Bertotti, Bruno (Univ. of Cambridge, Eng.). J. Math. Phys. (N. Y.), 7: 1349-50(Aug. 1966).

In special relativity, the Doppler shift between two freely moving identical oscillators is constant if their world lines are coplanar. It is shown that in general relativity, instead, the rate of change of their Doppler shift is proportional to a component of the space-time curvature, averaged along the light ray. A possible application to the detection of gravitational waves is discussed. (auth)

**44486** NONRELATIVISTIC QUANTUM THEORY OF AN ELECTRON IN AN ARBITRARILY INTENSE LASER FIELD. Nickle, H. H. (Robert Coll., Istanbul). J. Math. Phys. (N. Y.), 7: 1497-1506(Aug. 1966).

An essentially exact treatment of the time-dependent Schrödinger equation for a Bloch electron (or a free electron) in the presence of an arbitrarily intense laser field is described. Expressions for the wavefunction, current density, and energy of the electron state are presented in closed form for the case when the effective mass approximation is valid. The limitations of an "almost exact" solution of very simple form are investigated, the corrections to the almost exact solution being determined by the WKB approximation method. The exact solution for the wavefunction turns out to be quite different from that given by perturbation theory. However, the changes in the values of the current density and energy due to the presence of the laser field turn out to be, within the limitations imposed by the nonrelativistic nature of the Schrödinger theory, linear and quadratic in the field amplitude, and therefore agree with the results of perturbation theory. (auth)

**44487** SURVEY OF INVESTIGATIONS ON THE ENERGY-MOMENTUM COMPLEX IN GENERAL RELATIVITY. Moeller, C. (Niels Bohr Inst., Copenhagen. NORDITA, Copenhagen). Kongel. Dan. Vidensk. Selsk., Mat.-Fys. Medd., 35: No. 3, 1-13(1966).

A survey of the investigations of the last decade on the energy-momentum complex in general relativity is presented. A comparison of the properties of the various complexes proposed in different papers is performed and their advantages and deficiencies are discussed. A satisfactory solution of the energy problem in accordance with the general principle of relativity has now been reached. (auth)

**44488** AD HOC MODIFICATIONS OF QUANTUM ELECTRODYNAMICS. Kroll, N. M. (CERN, Geneva). Nuovo Cimento (10), 45A: 65-92(Sept. 1, 1966).

Ad hoc modifications of quantum electrodynamics are discussed with special reference to the restrictions imposed by charge conservation. It is shown that modifications in a charged-particle propagator typically require, in addition to the one-photon vertex modification imposed by the Ward identity, the introduction of a possibly infinite number of multiphoton vertices. A procedure, based upon a generalization of the notion of minimal electromagnetic interaction, for constructing the required vertices is given. In the absence of closed loops, it is shown that such propagator modifications have no effect upon the theory. Finally a general procedure is given for characterizing any theory consistent with charge conservation in terms of a modified propagator and intrinsic multiphoton vertices. The actual vertices which appear in the theory are generated by the propagator and intrinsic vertices in accordance with a well-defined procedure. An example is discussed. (auth)

**44489** MECHANICS IN EUCLIDIAN TERMS GIVING ALL THE THREE EINSTEIN EFFECTS. Rongved, L. (Bell Telephone Labs. Inc., Murray Hill, N. J.). Nuovo Cimento (10), 44B: 355-71(Aug. 11, 1966).

A discussion is presented on test particles in a radially symmetric and stationary gravitational field. It is shown that if the special theory of relativity is valid in the infinitesimal neighborhood of any point of such a field, then a single new assumption will suffice to yield equations that predict all the three Einstein effects. Notably, the equations suggest also an energy process associated with the motion of a test particle in a gravitational field that may give an explanation to such phenomena as novae and radio stars. It is shown that without further assumptions the equations for the radially symmetric and stationary field may be extended to a general scalar field theory. A simple solution of the latter theory reveals effects that may prove to be of interest to astronomy. A brief discussion is presented of a necessary modification of the corpuscular theory of light in order to bring it in line with the present theory. (auth)

**44490** ROUTE DEPENDENCE OF THE GRAVITATIONAL RED SHIFT. Kustaanheimo, P. Phys. Lett., 23: 75-7(Oct. 3, 1966).

The measurement is discussed for the relativistic red shift due to the gravitational field of the earth by means of the Mössbauer effect and using photons not traveling vertically. According to a new kind of linear theory of gravitation, the red shift for such photons may deviate from the value predicted by Einstein. (auth)

**44491** VARIATIONAL METHOD FOR THE GROUND STATE OF LIQUID $^4$He. Lee, Joon Chang; Broyles, A. A. (Univ. of Florida, Gainesville). Phys. Rev. Lett., 17: 424-6(Aug. 22, 1966).

A derivation of an equation for the radial distribution function g(r) by considering $\delta g(r)$ as arbitrary in order to study the ground state of liquid $^4$He is presented. (B.G.D.)

**44492** SINGULARITIES IN THE UNIVERSE. Hawking, S. W. (Cambridge Univ., Eng.). Phys. Rev. Lett., 17: 444-5(Aug. 22, 1966).

It is shown that space-time cannot be singularity free if the Einstein equations hold, matter has normal properties, and some reasonable global conditions hold. This would suggest that the Einstein theory probably breaks down in very strong fields. (auth)

**44493** SINGULARITIES IN CLOSED UNIVERSES. Geroch, R. P. (Princeton Univ., N. J.). Contract AF49(638)-1545. Phys. Rev. Lett., 17: 445-7(Aug. 22, 1966).

A theorem is established in order to show whether any nonsingular solutions of Einstein's equations can provide a reasonable model of the universe. (B.G.D.)

**44494** DEVELOPMENT OF QUANTUM ELECTRODYNAMICS. Tomonaga, Sin-itiro (Tokyo Univ.). Phys. Today, 19: No. 9, 25-8; 30-2(Sept. 1966).

The development of quantum electrodynamics is traced from its original formulation by Dirac to the calculation of the Lamb shift. The many-time theory which describes how the probability amplitude changes with time and in which space and time are treated with complete equality was proposed. A completely covariant formulation was found which, by a unitary transformation, corrected the defect of a lack of relativistically covariant meaning for a common time at different space points. The problem of infinities associated with field reactions was studied, and it was found that the most divergent part could be attributed to the infinity of mass or an apparent change in the electronic charge. Also the renormalization procedure can be used. Calculation of the Lamb shift concludes the review. (J.F.P.)

**44495** ROTATING FLUID MASSES IN GENERAL RELATIVITY. [PART] II. Boyer, R. H. (Univ. of Liverpool). Proc. Cambridge Phil. Soc., 62: 495-501 (July 1966).

Some properties of a stationary, isolated, axially symmetric, rotating body of perfect fluid are described, according to general relativity. The case of constant specific entropy and constant angular velocity is considered. The latter condition is equivalent to rigidity in the Born sense; both conditions are consequences of a simple variational principle. The hydrodynamic equations can then be integrated completely. Analogous first integrals are given also for the case of differential rotation. No use is made of the full field equations. (auth)

**44496** GRAVITATIONAL WAVES IN GENERAL RELATIVITY. IX. CONSERVED QUANTITIES. van der Burg, M. G. J. (Univ. of York, Eng.). Proc. Roy. Soc. (London), Ser. A, 294: 112-22(Sept. 6, 1966).

It is shown how the ten conserved quantities, recently discovered by E. T. Newman and R. Penrose by essentially geometrical techniques, arise in a direct solution of the Einstein field equations. For static fields it is shown that five of the conserved quantities vanish while the remaining five are expressed in terms of the multipole moments of the source distribution. (auth)

**44497** CONFORMAL THEORY OF GRAVITATION. Hoyle, F. (St. John's Coll., Cambridge, Eng.); Narlikar, J. V. Proc. Roy. Soc. (London), Ser. A, 294: 138-48 (Sept. 20, 1966).

Certain aspects of a new theory of gravitation are examined. It is shown that in the smooth fluid approximation, the familiar Einstein equations follow as a result of a specific conformal transformation. The equations of the theory differ from those of Einstein in the neighborhood of a particle, however. This is illustrated by means of an explicit solution. Criticisms of the theory by other authors are considered and discussed. (auth)

**44498** THEORY OF GRAVITATION. Ellis, G. F. R. (Univ. of Texas, Austin). Sci. Progr. (Oxford), 54: 387-99(Autumn 1966).

After describing some features of general relativity, some of the recent developments in the understanding of this theory are examined. Also discussed is the experimental status of general relativity, and its relation to other theories of gravitation. (auth)

**44499** THREE-BODY PROBLEM: EQUATION FOR PARTIAL WAVES. Badalyan, A. M.; Simonov, Ya. A. Yadern. Fiz., 3: 1032-47(June 1966). (In Russian).

The complete system of functions constructed by Simonov [Yadernaya Fizika 3: 4(1966)] is used to expand the three-particle wave function. The Schroedinger equation for three particles with an arbitrary potential is transformed into a connected system of equations for the partial waves, numbered by the momentum K in the six-dimensional space and by an index $\nu$. The partial waves depend on a single variable, the six-dimensional distance $\rho$. The potentials enter into the equations as the matrix elements $U_{KK'}^{\nu\nu'}$, the properties of which are investigated in detail. The relative value of $\chi_k^{\nu}(\rho)$ for various K is estimated. It is shown that $\sim\varkappa R$ partial waves, with $\varkappa = \sqrt{2m\epsilon|\hbar^2}$, are necessary to describe a system with the dimensions R and binding energy $\epsilon$. Partial waves with $K \gg \varkappa R$ decrease rapidly. The method can be applied with best advantage to $^3$H and $^3$He. (auth)

**44500** COMPLETE ANGULAR FUNCTION SET IN THE THREE-BODY PROBLEM FOR AN ARBITRARY ORBITAL MOMENTUM. Pustovalov, V. V.; Simonov, Yu. A. Zh. Eksp. Teor. Fiz., 51: 345-60(July 1966). (In Russian).

A complete set of independent angular functions (harmonic polynomials) which realize an irreducible representation of the rotation group in three-dimensional space and an irreducible representation of the permutation group for three particles is proposed. The functions obtained are proper functions of the total orbital momentum of the system L and its projection M on axis z. The degree of the polynomials K is the eigenvalue of the square of the global momentum in six-dimensional space. Symmetry relative to permutations is characterized by the symbol $\nu$. (auth)

## Low Temperature Physics

**44501** (CEA-R-3008) MATERIEL CRYOGENIQUE. (Cryogenic Equipment). Leger, Louis; Javellaud, Jean; Caro, Claude, Gilguy, Roger; Testard, Olivier (Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). June 1966. 33p. Dep. mn.

The cryostats presented here were built from standard parts; this makes it possible to construct a great variety of apparatus at minimum cost. The liquid nitrogen and helium reservoirs were designed so as to reduce losses to a minimum, and so as to make the cryostats as autonomous as possible. The experimental enclosure which is generally placed in the lower part of the apparatus requires a separate study in every case. Furthermore, complete assemblies such as transfer rods, isolated traps and high vacuum valves, were designed with a similar regard for the economic aspects and for the need for standardization. (auth)

**44502** (COO-1198-382) MAGNETIC PROPERTIES OF DILUTE SOLUTIONS OF LIQUID $^3$He IN $^4$He AT LOW TEMPERATURES. Sarwinski, Raymond Joseph (Illinois Univ., Urbana). Aug. 1966. Contract AT(11-1)-1198. 125p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Thesis.

The spin-diffusion coefficient and magnetic susceptibility of dilute solutions of $^3$He in $^4$He were measured down to about .003°K. These measurements were made on two solutions of nominal concentrations of 1.3 and 5.0% $^3$He in $^4$He under their own vapor pressures. The values of the diffusion coefficient fit $T^{*-2}$ laws below about .01°K for the 1.3% and below about .03°K for the 5.0% solutions in agreement with the Landau model of a Fermi liquid. The susceptibility is found to be constant at sufficiently low temperatures also in agreement with the Landau model. Dilute solutions of $^3$He in $^4$He are found to behave as weakly interacting Fermi systems with the advantage that the concentration, and therefore the Fermi temperature, can be varied from 0 to about 6% $^3$He. Since the system is weakly interacting, perturbation theory can be applied and the effective interaction potential between $^3$He particles can be deduced from measurements of the properties of these solutions at different concentrations. (auth)

**44503** (LA-DC-8165) DISSIPATION AND CRITICAL VELOCITIES IN SUPERFLUID HELIUM. Hammel, E. F.; Keller, W. E. (Los Alamos Scientific Lab., Univ. of California, N. Mex.). [1966]. Contract W-7405-eng-36. 47p. (CONF-660816-1). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From 10th International Conference on Low Temperature Physics, Moscow, USSR.

For the flow of an ordinary fluid it is well known that the entropy production may be expressed in terms of a dissipation function and the heat flux. In liquid He II the existence of two separate velocity fields introduces additional complexities into the problem of describing the entropy production processes. The relationships between these processes in He II and those in ordinary fluids are demonstrated by a discussion of the following topics: viscous dissipation by the normal fluid, with emphasis on thermal flow; dissipation due to a mutual force between the superfluid and the normal fluid; dissipation associated with turbulent normal fluid flow; dissipation due solely to the superfluid flowing through narrow channels and in the film. It is shown how each of these cases may be described analytically and separately identified from the experimental flow measurements. For each type of entropy production there is a critical fluid velocity at which the corresponding dissipation process begins to appear. In the past there has been considerable ambiguity in identifying these velocities from the observed changes in the flow properties of He II systems. However, it is now possible to distinguish and to characterize properly the various critical velocities, and the manner in which this may be done is described. (auth)

**44504** (UCRL-17026) A CALORIMETRIC INVESTIGATION OF SUPERCONDUCTIVITY IN $\alpha$-URANIUM. Phillips, Norman E.; Ho, James C.; Smith, T. F. (Lawrence Radiation Lab., Univ. of California, Berkeley). July 1966. Contract W-7405-eng-48. 9p. (CONF-660816-3). Dep. mm. CFSTI $1.00 cy, $0.50 mn.

From 10th International Conference on Low Temperature Physics, Moscow, USSR.

Although the occurrence of superconductivity in alpha uranium is of particular interest in connection with the role of the 5f states, the relevant experimental evidence is contradictory. To gain more information about the superconductivity of alpha uranium heat capacity measurements were made at zero pressure and at 10 kbar. (W.D.M.)

**44505** RADIATION-INDUCED PEAK EFFECT IN SUPERCONDUCTING NbZr. Keller, E. L.; Coffey, H. T.; Patterson, A.; Autler, S. H. (Westinghouse Research Labs., Pittsburgh). Appl. Phys. Lett., 9: 270-2(Oct. 1, 1966).

A peak in the critical current vs magnetic field characteristic of Nb–25% Zr was produced during a low-temperature (~30°K), 15-Mev deuteron irradiation ($10^{17}$ deuterons/cm$^2$). The peak occurs at fields near the upper critical field, $H_{c2}$; essentially no changes were observed at lower fields. Annealing at 77°K produced almost no change in the peak whereas it nearly disappeared after annealing at 300°K. It is concluded that this peak is a bulk effect associated with radiation-induced defects of intermediate size and complexity which are effective pinning centers near $H_{c2}$, but are too "weak" to affect the critical current at lower fields. A number of possible mechanisms are briefly discussed. (auth)

**44506** CERAMIC SEMICONDUCTORS FOUND SUPERCONDUCTING. Cryog. Eng. News, 1: No. 11, 22-3(Sept. 1966).

Transitions to the superconducting state were produced in ceramic samples of strontium titanate and in mixed-composition samples of barium–strontium titanates and calcium–strontium titanates. The findings are significant because they indicate that by varying the composition of semiconducting materials it is possible to control the essential parameters of the superconducting state in these materials. The specimens of doped strontium titanate were prepared with a 0 to 20% substitution of barium and a 0 to 100% substitution of calcium. When these samples were tested, the barium-doped strontium titanate was superconducting up to approximately 12% added barium. Calcium-doped strontium titanate exhibited superconductivity up to approximately 35% or 45% added calcium. (J.H.M.)

**44507** P-V-T AND INTERNAL ENERGY DATA FOR HELIUM BETWEEN 4.2 AND 20 DEG K AT PRESSURES OF 100-1,300 atm. Glassford, P. M.; Smith, J. L. Cryogenics, 6: 193-206(Aug. 1966).

A constant volume calorimeter was constructed and twelve isochors were determined. The internal energies for each of the isochors were determined. A constant volume gas thermometer was used for temperature measurements. The data were used to evaluate the pressure-temperature curve for melting, the derivative $(\partial p/\partial T)_v$, the specific heat at constant volume, the volumes of saturated fluid and solid, and the latent heat of melting. The data were compared with existing data and thermodynamic consistency was examined. (auth)

**44508** SENSITIVE DETECTION OF SUPERCONDUCTIVITY BY CHANGES IN INDUCTANCE AND LOSSES OF A RESONANT BRIDGE. Lindsay, J. D. G.; White, R. W.; Fowler, R. D. Cryogenics, 6: 213-15(Aug. 1966). (LA-DC-7646(Rev.)).

A resonant bridge circuit is described that can detect superconductivity in microgram quantities of material. No electrical connections are required since the apparatus makes use of the changes in the inductance and loss of a solenoid containing the material to be tested. The apparatus also permits the measurement of the critical field of the superconductor. (auth)

**44509** INVESTIGATION OF HIGH-CURRENT-CARRYING LEADS INTO LIQUID HELIUM. Keilin, V. E.; Klimenko, E. Yu. Cryogenics, 6: 222-8(Aug. 1966).

The condition of lowering the helium evaporation rate due to high current-carrying loads cooled by the effluent gas was investigated both experimentally and theoretically. The results of analysis and experiments proved to be in good agreement and indicate that the evaporation rate due to current-carrying loads depends weakly on the size and on the hot end temperature of the leads. The effect of use of combined leads, i.e., superconductors in a good thermal and electrical contact with normal metals, is quantitatively estimated. (auth)

**44510** INFLUENCE OF CHARGE EFFECTS ON THE ELECTRICAL CONDUCTIVITY OF THIN METAL FILMS. Alsford, R. W. (Plessey Co. Ltd., Romsey, Eng.); Hayes, R. E.; Kennedy, D. I. Electron. Lett., 2: 327(Sept. 1966).

Investigations were made on the electric resistance of evaporated films of lead, tin, indium, and gold, less than 600 mÅ thick. It was found that lower-resistance films could be obtained if arrangements were made to reduce the accumulated charge appearing on the substrate. (auth)

**44511** DESTRUCTION OF THIN FILM SUPERCONDUCTIVITY BY CURRENT PULSES. Udzulashvili, G. A.; Chigvinadze, D. G.; Shukhman, V. A. pp 90-3 of Elektronnye i Ionnye Protsessy v Tverdykh Telakh. I. Tbilisi, Georgian SSR, Izdatel'stvo Metsniereba, 1964. (In Russian).

Characteristics of tin films, $10^{-5}$ cm thick, at their transition into the normal state, were studied during the passage of current pulses of a microsecond range through them. The transition of the films was found to be longer for significant intervals of current amplitude. The possibility of explaining the extent of transition becoming longer is discussed in relation to thermal effects. (auth)

**44512** A 137-kA/cm-0.1 sec DOUBLE COIL PULSE APPARATUS WITH A 28-mm INNER DIAMETER. Lange, Felix (Institut fuer Tieftemperaturphysik, Deutsche Akademie der Wissenschaften, Dresden). Exp. Tech. Phys., 13: 457-62(1965). (In German).

The characteristics of a 137-kamp/cm-0.1 sec double coil pulse apparatus for studies with superconductors were described. (J.S.R.)

**44513** DETERMINATION OF THE CRITICAL TEMPERATURE OF SUPERCONDUCTORS WITH PARAMAGNETIC ADMIXTURES. Palistrant, M. E.; Moskalenko, V. A. (Inst. of Physics and Mathematics, Moldavian Academy of Sciences, USSR). Fiz. Metal. Metalloved., 21: 280-1(Feb. 1966). (In Russian).

The effect of the delay of the interelectron interaction on the critical temperature $T_c$ of superconductors containing paramagnetic admixtures was investigated on the basis of Fröhlich's Hamiltonian, using $T_c$ as the eigenvalue in the equation of the bound state of electron or hole pairs possessing opposite pulses and spins. By means of the diagram technique of the thermodynamic perturbation theory, an equation was derived for the two-part Green function for the case involving the presence of a paramagnetic admixture. An expression containing a term related to the effect of interelectron interaction was obtained to determine the critical temperature of the superconductor. In the Einstein spectrum approximation, the correction arrived at is equal to $(3\pi/4\tau_s)(T_c^0/T_D)$, where $\tau_s$ is the relaxation time and $T_D$ is the Debye temperature. The value of the ratio $3T_c^0/T_D$ was found to be 0.03; therefore the effect of the delay of $T_c$ was found to be negligible in the low concentration range of the admixture. (TTT)

**44514** EFFECT OF STRUCTURE ON THE SUPERCONDUCTING PROPERTIES OF EUTECTIC ALLOYS. Levy, S. A. (Bell Telephone Labs., Murray Hill, N. J.). Kim, Y. B.; Kraft, R. W. J. Appl. Phys., 37: 3659-65 (Sept. 1966).

The superconducting properties of twelve eutectic alloys were studied. The seven alloys that were eutectics between terminal solid solutions were found to behave as type I superconductors irrespective of the solidification rate. Five other eutectic systems, all of which contained at least one intermetallic compound, were found to behave as type II superconductors. For the type II alloys a linear variation between the current-carrying capacity and the interphase boundary area per unit volume was observed. Of the type II alloys, eutectics containing one superconducting and one nonsuperconducting phase were found to be more structure-sensitive than those having both phases superconducting. (auth)

**44515** SUPERCONDUCTING TRANSITION TEMPERATURES OF LEAD ALLOYS. Sato, Masayoshi; Kumasaka, Nobuyuki; Mitani, Masao (Hitachi Central Research Lab., Tokyo). J. Phys. Soc. Jap., 21: 1617(Aug. 1966).

Data are presented of the superconducting transition temperature, obtained by a self-inductance method, for lead alloys with 1 ~ 11 at.% additions of Sb, Bi, Sn, Tl, and In. Measured differences are shown between the superconducting transition temperature of the alloys and that of a pure lead standard specimen, as a function of solute concentration. (J.H.M.)

**44516** INSTABILITY OF FERMI SYSTEMS AND SPECIFIC HEAT OF LIQUID $^3$He. Kirzhnits, D. A.; Nepomnyashchii, Yu. A. (Lebedev Physics Inst., Moscow). JETP Lett. (USSR) (Engl. Transl.), 4: 58-61(Aug. 1, 1966).

Translated from Zh. Eksperim. Teor. Fiz., Pis'ma Redakt., 4: 86-90(Aug. 1, 1966).

A possible explanation is given for the anomaly of the specific heat of $^3$He, based on the fact that the long-range attraction forces are capable also of leading to a phase transition of an essentially different nature, with a value of $AT/T_c$ which is assuredly larger. (M.O.W.)

**44517** NUCLEAR MAGNETIC RESONANCE IN THE RESISTIVE STATE OF SUPERCONDUCTORS OF THE SECOND KIND. Kulik, I. O. (Physico-Technical Inst. of Low Temperatures, Academy of Sciences, Ukrainian SSR). JETP Lett. (USSR) (Engl. Transl.), 4: 95-6(Aug. 15, 1966).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Redaktsiyu, 4: 138-40(Aug. 15, 1966).

As shown earlier the motion of magnetic flux filaments in superconductors of the second kind in the resistive state ($H_{c1} < H < H_{c2}$, $j_\perp > j_{cr}$) leads to the occurrence of h-f radiation, which is monochromatic if the filaments form a regular lattice and move with constant velocity. A method is briefly outlined for observing this phenomenon with the aid of nuclear magnetic resonance. (M.O.W.)

**44518** DYNAMICAL REARRANGEMENT OF SYMMETRIES. III. SUPERCONDUCTIVITY. Leplae, L.; Umezawa, H. (Univ., Naples. GNSM, Naples). Nuovo Cimento (10), 44B: 410-26(Aug. 11, 1966).

Applying the formulation of dynamical rearrangement to the case of neutral superconductivity, an expression is derived for the electron field operator written explicitly in terms of the operators of the quasi-electrons and collective excitations. Making use of this expression various quantities are written, in particular the current, in terms of the operators of quasi-electrons and collective excitations. It turns out that the field of the collective excitation is the canonical conjugate of the total number which is the generator of the phase transformation and that only this field responds to the gauge transformation, while the quasi-fermions do not (i.e. the dynamical rearrangement of gauge symmetry). In other words, this field plays the role of the phase operator and mediates the correlation of phases. It is shown that this phase operator is precisely the Goldstone field. (auth)

**44519** LONDON MOMENT OF ROTATING SUPERCONDUCTORS AND LENSE-THIRRING FIELDS OF GENERAL RELATIVITY. Papini, G. (Univ. of North Carolina, Chapel Hill). Nuovo Cimento (10), 45B: 66-8 (Sept. 11, 1966).

It has been known for a long time that a superconductive body of axial symmetry when rotated about its symmetry axis should generate a magnetic field. The effect was recently confirmed experimentally. Its connection is pointed out here with the Lense-Thirring fields of general relativity and it is shown that from the point of view of Mach's principle the result is equivalent to that derived earlier. (M.O.W.)

**44520** NUMERICAL CALCULATIONS ON HIGH-FIELD SUPERCONDUCTIVITY. Avenhaus, Rudolf (Technische Hochschule, Karlsruhe, Ger.); Fulde, Peter. Phys. Kondens. Mater., 5: 157-65(1966).

Numerical calculations are presented for the field dependence of critical currents in high-field superconductors. The computations are done under two simplifying assumptions, namely that the fluxoids are pinned strongly enough so that flux creep and flux flow does not have to be taken into account, and that spin orbital interaction can be neglected. Only the zero temperature limit is considered. Furthermore, a diagram is calculated with the help of which the following three fields can be read off easily for a given sample: the supercooling and superheating critical field and the field for which the energies in the normal and superconducting state are equal. (auth)

**44521** SOME DETAILS OF FLUX RETENTION PROCESSES IN HYSTERETIC SUPERCONDUCTORS. Schweitzer, D. G.; Bertman, B. (Brookhaven National Lab., Upton, N. Y.). Phys. Lett., 22: 361-2(Sept. 1, 1966). (BNL-10346).

The dependence of the retained flux in zero field on the magnitude of the internal field and maximum applied field was determined at various temperatures in a number of different superconductors. Some simple relationships common to all the systems studied are described. (auth)

**44522** THE NATURE OF THE 50 c/s PHASE TRANSITION IN TYPE II SUPERCONDUCTORS. Rogers, E. C. (BICC, London). Phys. Lett., 22: 365-7(Sept. 1, 1966).

Experimental results are given which demonstrate that the 50 cps superconducting-to-normal transition in type II superconductors is not in general caused by heating due to a-c losses, but is due rather to the peak current attaining a critical value. (auth)

**44523** MAGNETIC TRANSITIONS IN EuSe. Schwob, P.; Vogt, O. (Eidgenoessische Technische Hochschule, Zurich). Phys. Lett., 22: 374-5(Sept. 1, 1966).

Below 3.8°K EuSe exhibits a spontaneous magnetization. Anisotropy energies are very low. (auth)

**44524** EFFECT OF A MAGNETIC FILM COATING ON THE SUPERCONDUCTING SURFACE SHEATH OF A TYPE-II SUPERCONDUCTOR. Hauser, J. J. (Bell Telephone Labs., Inc., Murray Hill, N. J.). Phys. Lett., 22: 378-9(Sept. 1, 1966).

It is shown that the surface nucleation field ($H_{c3}$) of a type-II superconductor S is reduced when the superconductor is coated with a magnetic film M, even when the conductivity $\sigma_M$ of M is smaller than the normal state conductivity $\sigma_S$ of S. (auth)

**44525** ENERGY AND PURITY DEPENDENCE OF THE DENSITY OF STATES IN THE GAPLESS REGION OF TYPE-II SUPERCONDUCTORS. Neumann, L. (Univ., Hamburg). Phys. Lett., 22: 396-7(Sept. 1, 1966).

The space average of the density of states in bulk type-II superconductors is calculated for magnetic fields slightly below the upper critical field. The resulting expression applies to all energies, mean free paths, and temperatures. (auth)

**44526** PRESSURE CONTACTS BETWEEN A SUPERCONDUCTOR AND A NORMAL METAL. Fournet, G.; Millerton, P. F. (Laboratoire Central des Industries Electriques, Fontenay-aux-Roses, France). Phys. Lett., 22: 398-9(Sept. 1, 1966).

The behavior of pressure contacts between a superconductor and a normal metal is studied here for high intensities. The V-I characteristics can show a bend or a break for a certain I of order 10 A. A simple model is given which explains shape of the curves. (auth)

**44527** ABSENCE OF A LINEAR TERM IN THE HEAT CAPACITY OF hcp $^4$He. Ahlers, G. (Bell Telephone Labs., Inc., Murray Hill, N. J.). Phys. Lett., 22: 404-5 (Sept. 1, 1966).

Contrary to other investigations, precision low temperature heat capacity measurements for hcp $^4$He between 13.7 and 15.1 cm$^3$/mole revealed no contribution linear in temperature. Any linear term must be at least one order of magnitude smaller than the smallest previously reported. (auth)

**44528** PEAK EFFECT IN THE MAGNETIZATION OF SUPERCONDUCTING NIOBIUM. Tsuda, N.; Koike, S.; Suzuki, T. (Tokyo Univ.). Phys. Lett., 22: 412-13 (Sept. 1, 1966).

The peak effect in dB/dH at $H_{c2}$ was observed. This is explained in terms of the interaction of the Abrikosov lattice with dislocations using the two fluid model. The interaction energy is estimated to be about $3 \times 10^{-8}$ erg/cm. (auth)

**44529** ANOMALOUS ATTENUATION OF ULTRASONIC WAVES IN SUPERCONDUCTING NIOBIUM. Tsuda, N.; Koike, S.; Suzuki, T. (Tokyo Univ.). Phys. Lett., 22: 414-15(Sept. 1, 1966).

Anomalous absorption at $H_{c1}$ and a deviation of the temperature variation of $\alpha_s/\alpha_n$ from the BCS relation were found in the measurements of the ultrasonic attenuation in superconducting niobium. (auth)

**44530** REMOVAL OF SUPERCONDUCTING SURFACE-SHEATH BY COPPER-PLATING. Malseed, C. F. S.; Nethercott, R. B.; Rachinger, W. A. (Monash Univ., Victoria, Australia). Phys. Lett., 22: 551-2(Sept. 15, 1966).

It was observed that plating a type-II superconductor with copper caused a marked reduction of $H_{c3}$. (auth)

**44531** SUPERCONDUCTING CONTACTS IN HIGH MAGNETIC FIELDS. Pankove, J. I. (RCA Labs., Princeton, N. J.). Phys. Lett., 22: 557-8(Sept. 15, 1966).

"Supercurrents" through contacts between oxidized superconductors have previously been observed at biases in excess of $2\Delta$ at $H = 0$ and now they have also been observed at magnetic fields greater than $H_{c2}$. An anomalous magnetoresistance occurs in Pb–PbO–Pb contacts. (auth)

**44532** NEW MODE OF FIELD ENHANCEMENT IN SUPERCONDUCTING TUBES. Young, E. F.; Gayley, R. I. (State Univ. of New York, Buffalo). Phys. Lett., 23: 15-16(Oct. 3, 1966).

A new mode of field enhancement in superconducting tubes, which does not involve cooling the specimen, is reported. When an applied field breaks into the hole of a very thick-walled tube, as a result of either increasing the field at constant temperature or warming at constant field, the field strength rises to a value that is larger than that of the applied field. The effect is more pronounced in a short specimen. (auth)

**44533** STRUCTURE IN THE $d^2V/dI^2$ VERSUS V CHARACTERISTIC OF Pb-INSULATOR-METAL TUNNEL JUNCTIONS. Marcus, S. M. (E. I. du Pont de Nemours and Co., Wilmington, Del.). Phys. Lett., 23: 28-9(Oct. 3, 1966).

Structure was observed in the $d^2V/dI^2$ versus V characteristics of Pb-insulator-metal tunnel junctions at voltages from 25 to 65 mv across the junctions. The measurements were performed at liquid He temperatures. (auth)

**44534** INTERNAL SURFACE SUPERCONDUCTIVITY: THE RELATIONSHIP BETWEEN RESISTIVE CRITICAL FIELD AND BULK UPPER CRITICAL FIELD. Ralls, K. M. (Univ. of California, Berkeley). Phys. Lett., 23: 29-31(Oct. 3, 1966).

The importance of internal surface superconductivity with respect to resistive measurements is pointed out. Critical current density versus transverse magnetic field data for a well-annealed 75Nb-25Zr alloy, are presented and discussed. (auth)

**44535** MEASUREMENT OF CRITICAL FIELD $H_{c3}$ AND CRITICAL SURFACE CURRENT IN SUPERCONDUCTING V–Ti ALLOYS UP TO 30 kOe. Kwasnitza, K.; Rupp, G. (Univ., Erlangen, Ger.). Phys. Lett., 23: 40-2(Oct. 3, 1966).

The upper critical field $H_{c3}$, the ratio $H_{c3}/H_{c2}$ and the critical surface current $J_c$ in V–Ti alloys containing up to 12 at. % Ti and having high $\kappa$ values were measured and compared with theoretical predictions. $H_{c3}/H_{c2}$ is found in the vicinity of 1.7. The measured field dependence of critical surface current near $H_{c3}$ deviates from Abrikosov's theoretical formula. The influence of surface condition on $H_{c3}$ and $J_c$ is weak. (auth)

**44536** DISPERSION OF TRANSVERSE SOUND IN SUPERCONDUCTORS. Ozaki, H. (Waseda Univ., Shinjuku, Tokyo); Mikoshiba, N. Phys. Lett., 23: 52-3(Oct. 3, 1966).

A dynamical change in velocity of high-frequency transverse sounds at the superconducting transition temperature is shown to be much larger than a static change estimated from thermodynamical considerations. (auth)

**44537** THE GINZBURG-LANDAU PARAMETER ($\kappa_0$) FOR VANADIUM. French, R. A. (Clarendon Lab., Oxford). Phys. Lett., 23: 59-61(Oct. 3, 1966).

Magnetic and resistive measurements on an impure vanadium crystal, indicate $\kappa_0$, the Ginzburg-Landau parameter in the limit of infinite mean free path, to be about 0.85, in contrast with another recent estimate. (auth)

**44538** ANALOGIES OF THE ETTINGSHAUSEN- AND PELTIER EFFECTS IN THE MIXED STATE OF TYPE II SUPERCONDUCTORS. Van Vijfeijken, A. G. (Philips' Research Labs., Eindhoven, Netherlands). Phys. Lett., 23: 65-7(Oct. 3, 1966).

Calculations for two thermogalvanomagnetic effects, occurring in the mixed state of type II superconductors, are given. A comparison with two recent experiments is made. (auth)

**44539** ANGULAR DEPENDENCE OF MUTUAL FRICTION IN ROTATING HELIUM II. Snyder, H. A.; Putney, Zimri (Brown Univ., Providence). Phys. Rev., 150: 110-17(Oct. 7, 1966).

Measurements were made of the attenuation of second sound in a rectangular rotating resonant cavity. The resonator can be tilted about one of its symmetry axes so that second sound is propagated at various angles $\vartheta$ to the rotational axis. The attenuation as a function of $\vartheta$ is in good agreement with the predictions of Hall and Vinen's equations of motion for helium II. However, the absolute values of the mutual-friction parameter B are about 20% below previously reported values. In the course of the experiments it was found that second-sound attenuation in a resonator made of porous material depends strongly upon whether the resonator is surrounded with a shield rotating with the resonator or is sloshing in the helium bath. In the latter case it is shown that isotropic superfluid turbulence is produced inside the resonator. (auth)

**44540** EXPERIMENTAL TEST OF THE JOSEPHSON FREQUENCY-VOLTAGE RELATION. Langenberg, D. N.; Parker, W. H.; Taylor, B. N. (Univ. of Pennsylvania, Philadelphia). Phys. Rev., 150: 186-8(Oct. 7, 1966).

The Josephson frequency-voltage relation in superconduction's $\nu = 2eV/h$ was tested by measuring frequency-voltage ratios in Josephson junctions using three different Josephson-effect phenomena: microwave emission from evaporated-film tunnel junctions, microwave-induced quantum voltages in evaporated-film tunnel junctions, and microwave-induced current steps in the I-V characteristics of evaporated-film tunnel junctions and of "weak-link" point-contact junctions. The use of the "harmonic effects" associated with each phenomenon to increase the accuracy of measurement, and the factors limiting the accuracy in each case, are discussed. The measured frequency-voltage ratios for the three methods were the same to within their respective experimental errors. The highest accuracy was obtained using microwave-induced current steps. The measured frequency-voltage ratio in this case was equal to the currently accepted value of 2e/h to within an experimental accuracy of 0.006% (60 ppM). The frequency-voltage ratio was also found to be independent of the type of junction used, temperature, magnetic field, harmonic number, voltage polarity, microwave power, and frequency to within the 10-ppM precision of the measurements. (auth)

**44541** LITTLE'S PROPOSAL FOR A SUPERCONDUCTING ORGANIC POLYMER. Kuper, C. G. (Hebrew Univ., Jerusalem). Phys. Rev., 150: 189-92(Oct. 7, 1966).

It is shown that electrons constrained to move along a narrow cylinder are ineffective in screening the Coulomb field of a test charge. Little's attractive interaction between the electrons of a certain type of polymer is insufficiently large to overcome the unscreened Coulomb repulsion between electrons, and it is therefore improbable that a polymer of this type will be superconducting. An additional argument suggests that this failure of the Little model is not accidental, and that superconducting behavior can never be produced by constraints imposed on an electron gas. (auth)

**44542** NEW MECHANISM FOR SUPERCONDUCTIVITY. Luttinger, J. M. (Columbia Univ., New York). Phys. Rev., 150: 202-14(Oct. 7, 1966).

A new mechanism which leads to superconductivity even for particles with purely repulsive forces between them is described. The general theory is given for weak short-ranged pair forces between the particles and for arbitrary (convex) Fermi surfaces. It is shown that the transition temperature due to this mechanism is in general quite low, though it may be enhanced somewhat by very special Fermi-surface geometry. (auth)

**44543** CRITICAL MAGNETIC FIELD OF THIN SUPERPOSED FILMS. Klein, Rudolf; Fischer, Gaston (RCA Labs. Ltd., Zurich). Phys. Rev., 150: 222-5(Oct. 7, 1966).

Thin superposed films of two superconductors or of a superconductor and a normal metal are studied in a parallel magnetic field near a second-order transition. From the linearized integral equation for the position-dependent order parameter and the boundary conditions for the magnetic-field-dependent kernel at the interface, an implicit equation for the critical magnetic field is derived under the assumption that the order parameter has a different but constant value in each film. Near the transition temperature of the double film $T_{cns}$ and at the absolute zero of temperature, the results are expressed in terms of the usual relevant parameters characterizing the two constituents of the compound film, and are compared with some recent experimental data. (auth)

**44544** DIFFERENTIAL PARAMAGNETIC EFFECT AND HARMONIC GENERATION IN AN ENCLOSED SUPERCONDUCTOR. Gayley, R. I. (State Univ. of New York, Buffalo). Phys. Rev., 150: 257-63(Oct. 7, 1966).

The low-frequency behavior of a cylindrical enclosed superconductor (superconducting coaxial cable) is discussed, with particular attention to the case in which the inner conductor is in the intermediate state. Preliminary observations of an effect which is equivalent to the familiar differential paramagnetic effect (DPE) are reported. A qualitative explanation is developed by a detailed analysis of the ideal case, which corresponds to the limit in which the phase boundaries follow the a-c field perfectly. For the specimen studied, in which the DPE is reduced from the ideal value, a model is proposed based on the assumption that the intermediate state is composed of only a few normal and superconducting regions. In addition to accounting for the lack of reproducibility of the DPE on different trials, this model makes it possible, in principle, to relate the DPE directly to the velocity of propagation of the phase boundaries, although the data are not yet adequate for this purpose. The DPE was observed by means of a coaxial pair of coils wound directly on the inner superconductor. Under conditions such that the boundary motion led to switching of the inner conductor from the intermediate to the normal state or from the intermediate to the superconducting state, a strong harmonic content was observed. A brief analysis of this harmonic content is presented. Phase-boundary motion was observed directly in an auxiliary two-frequency experiment in which the low-frequency boundary motion was monitored by a high-frequency signal. (auth)

**44545** SUPERCONDUCTING TRANSITION AND CRITICAL FIELD OF PURE GALLIUM SINGLE CRYSTALS. Gregory, William D.; Sheahen, Thomas P.; Cochran, J. F. (Massachusetts Inst. of Tech., Cambridge). Contract SD-90. Phys. Rev., 150: 315-21(Oct. 7, 1966).

The superconducting critical temperature $T_c$ and critical field curve for pure gallium were measured using a $^3$He vapor-pressure thermometer. The critical field $H_c(T)$ has been measured in the temperature range 0.82 – 1.083°K. Within experimental error the results of the measurements can be expressed as $H_c(T) = 56.48[(1 - t^2) - 0.0314 \sin\pi(1 - t^2)]$, or $H_c(T) = 100.86(1 - t) - 36.18(1 - t)^2$, or $(1 - t^2) = (H_c/57.807) + 0.0424 \sin(\pi H_c/57.807)$, where $t = T/T_c$, and $T_c = 1.0833 \pm 0.0005$°K. The derivative of the critical field at $T_c$ is $(dH_c/dT)_{T_c} = -93.8 \pm 0.5$ G/°K, or $(dh/dt)_1 = -1.72$ in reduced coordinates. The superconducting energy gap at 0°K is estimated to be $2\Delta_0/kT_c = 3.32$, and the mean square anisotropy of the gap, $\langle a^2 \rangle$, is estimated to be 0.04 from the deviation of the critical field curve from the BCS form. (auth)

**44546** SUPERCONDUCTING PROPERTIES AND ANISOTROPIC ELECTRICAL RESISTIVITIES OF PURE AND CADMIUM-DOPED TIN. Gueths, J. E.; Reynolds, C. A.; Mitchell, M. A. (Univ. of Connecticut, Storrs). Contract NONR-2967(00). Phys. Rev., 150: 346-55(Oct. 7, 1966).

Approximately 60 cylindrically shaped single crystals of pure and cadmium-doped (<%1 Cd) tin in the tetragonal phase were prepared. Electrical-resistivity determinations were made at 373, 273, 77, and 4.2°K. An investigation was made of the variation of the superconducting critical-field parameters with impurity content. The anisotropy of the temperature-dependent electrical resistivity $\rho(T)$ for pure tin was determined. $\rho_\parallel(T)$ $\rho_\perp(T)$ is found to be $1.53 \pm 0.01$ at 373°K, $1.555 \pm 0.009$ at 273°K, and $1.684 \pm 0.010$ at 77°K. $\rho_\perp(T)$ is $13.25 \pm 0.05$, $9.05 \pm 0.03$, and $1.772 \pm 0.006$ $\mu\Omega$-cm at 373, 272, and 77°K respectively. The anisotropy of the residual resistivity $\rho_0$ for cadmium impurity was determined at 4.2°K by two different experimental methods in different regions of impurity concentration x. $\rho_{0\parallel}/\rho_{0\perp}$ is found to be 1.6 ± 0.1 in both regions. The residual resistivity for any specific crystal orientation is found to vary linearly with x ($\rho_{0\perp}/x = 1.39\ \mu\Omega$ cm at.%). Deviations from Matthiessen's rule are found to vary linearly [$\rho(T)_{impure} - \rho(T)_{pure} = 0.16\rho_{0\perp}$] with impurity concentration and appear to be temperature-independent for 77°K ≤ T ≤ 373°K. The general features of the data relating the change in superconducting transition temperature ($T_c$) with doping are in good agreement with the data of Lynton, Serin, and Zucker. However, there is evidence for anomalous $T_c$ behavior in the region of composition ($x \approx 0.3\%$) at which a lattice-spacing anomaly was reported by Lee and Raynor. The development of vacant sites as reported by Lee and Raynor in this region is not observed in plots of $\rho_{0\perp}$ versus x, however. The theory of Markowitz and Kadanoff is applied to the data relating $T_c$ to impurity concentration. Reasonable agreement between the theory and experiment is found. The mean-squared relative anisotropy of the superconducting energy gap, parameter $\langle a^2 \rangle$, is found from this analysis to be 0.023. A recent theoretical treatment due to Clem which describes the change in the critical-field parameters with doping is compared to our experimental results. The so-called "similarity conditions" are found not to be satisfied. The shape of the reduced critical-field curve is found to be a function of impurity concentration. The value of $\langle a^2 \rangle$ obtained from our data employing Clem's equations is 0.022, in good agreement with the value obtained from the $T_c$ data alone. The data describing the reduced critical-field curve of pure tin is in good agreement with the results of Shaw et al. The change in shape of the reduced critical-field curve can be understood both qualitatively and quantitatively in terms of the reduction of the effects of $\langle a^2 \rangle$ with doping as given by Clem's theoretical treatment. (auth)

**44547** TOMASCH EFFECT AS A PROBE OF THE DISPERSION RELATION OF ELECTRONS IN "GAPLESS" SUPERCONDUCTORS. Maki, K.; Griffin, A. (Univ. of California, San Diego, La Jolla). Phys. Rev., 150: 356-60 (Oct. 7, 1966).

The recent theory of McMillan and Anderson is used to discuss the effect of nonmagnetic impurities and depairing mechanisms on the period and damping of the Tomasch oscillations. These oscillations in the density of states seem to provide a unique way of directly measuring the dispersion relation of electronic excitations in superconductors [$\omega$ versus $\mathrm{Re}(\tilde{\omega}^2 - \tilde{\Delta}^2) \propto$ pseudomomentum k*, where $\tilde{\omega}$ and $\Delta$ are the usual renormalized diagonal and off-diagonal self-energies]. The theoretical dispersion curves for films with a small concentration of magnetic impurities and for dirty films ($l \ll \xi_0$) in the presence of a parallel magnetic field are discussed. The two situations lead to quite different dispersion curves at small values of k*, for the same value of the depairing parameter. Using the Tomasch effect to plot out the dispersion curves becomes more difficult as $\omega$ decreases, since the damping of the oscillations [$\propto \mathrm{Im}(\tilde{\omega}^2 - \tilde{\Delta}^2)^{1/2}$] increases. (auth)

**44548** FAR INFRARED RESPONSE OF POINT-CONTACT JOSEPHSON JUNCTIONS. Grimes, C. C.; Richards, P. L.; Shapiro, S. (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Lett., 17: 431-3(Aug. 22, 1966).

The spectral-response curves of superconducting point contacts suggesting the existence of frequency-dependent Josephson current amplitudes peaking in the vicinity of the energy gap were measured. These point-contact Josephson junctions respond sensitively and with high speed to millimeter and submillimeter radiation. Radiation emitted to free space by one such junction was detected by another junction. (auth)

**44549** EFFECT OF FERROMAGNETIC SPIN CORRELATIONS ON SUPERCONDUCTIVITY. Berk, N. F.; Schrieffer, J. R. (Univ. of Pennsylvania, Philadelphia). Phys. Rev. Lett., 17: 433-5(Aug. 22, 1966).

It is shown from first principles that ferromagnetic spin correlations which arise from strong Coulomb interactions between valence electrons lead to an enhanced singlet-state repulsion. (B.G.D.)

**44550** ANOMALOUS DEPENDENCE OF THE SUPERCONDUCTING TRANSITION TEMPERATURE ON PARAMAGNETIC IMPURITIES. Bennemann, K. H. (Univ. of Chicago). Phys. Rev. Lett., 17: 438-43(Aug. 22, 1966).

It is shown that the magnetic ordering of paramagnetic impurities in superconducting alloys gives rise to a very different dependence of the superconducting transition temperature on the concentration of paramagnetic impurities than is expected for paramagnetic alloys. (B.G.D.)

**44551** NORMAL JOSEPHSON JUNCTIONS AND QUANTUM COHERENCE. Vant-Hull, L. L.; Mercereau, J. E. (California Inst. of Tech., Pasadena). Phys. Rev. Lett., 17: 629-31(Sept. 19, 1966).

The observation is reported of self-stimulated phase coherence effects in "normal" Josephson junctions and a consistent interpretation of the quantitative behavior is provided. These "normal" junctions were utilized to demonstrate quantum phase coherence in tin films at distances up to 1.33 m. (M.O.W.)

**44552** ENHANCEMENT OF SUPERCONDUCTIVITY IN METAL FILMS. Abeles, B.; Cohen, Roger W.; Cullen, G. W. (RCA Labs., Princeton, N. J.). Phys. Rev. Lett., 17: 632-4(Sept. 19, 1966).

The effect of crystallite size on the transition temperatures of Al, Ga, Sn, In, and Pb was investigated. The results show that small crystallite size can increase the $T_c$'s of many superconductors. (M.O.W.)

**44553** ULTRASONIC EVIDENCE FOR STRONG COUPLING OF ELECTRONS TO TRANSVERSE PHONONS IN SINGLE-CRYSTAL INDIUM. Leibowitz, J. R.; Fossheim, K. (Univ. of Maryland, College Park). Phys. Rev. Lett., 17: 636-9(Sept. 19, 1966).

Experimental evidence is reported for strong "residual" coupling of low-temperature transverse phonons to the conduction electrons in indium. The data describe the set of deformation integrals over the zones of electron-phonon interaction for essentially the complete array of transverse, as well as longitudinal, pure propagation modes in single-crystal indium. (M.O.W.)

**44554** MANY MORE SUPERCONDUCTING BISMUTH PHASES. Matthias, B. T.; Jayaraman, A.; Geballe, T. H.; Andres, K.; Corenzwit, E. (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Lett., 17: 640-3(Sept. 19, 1966).

A number of superconducting Bi phases prepared by high-pressure and -temperature synthesis and retained at atmospheric pressure is reported. Experimental results are given for $Bi_2Ag$, BiCo, BiCu, $Bi_2Ir$, $Bi_4Mg$, $Bi_3Mg$, $Bi_3Mo$, $BiRe_2$, BiRu, $Bi_3Sn$, $Bi_3Te$, $Bi_3Zn$, and $BiZr_3$. (M.O.W.)

**44555** INSTABILITY OF HELIUM II IN POTENTIAL FLOW BETWEEN ROTATING CYLINDERS. Bendt, Philip J. (Univ. of California, Los Alamos). Phys. Rev. Lett., 17: 680-2(Sept. 26, 1966).

The attenuation of second sound was used to locate hydrodynamic flow transitions in steady-state potential flow of helium II between concentric rotating cylinders. Absence of vorticity is observed until the first transition. (auth)

**44556** MEASUREMENT OF A BARRIER FOR THE EXTRACTION OF EXCESS ELECTRONS FROM LIQUID HELIUM. Bruschi, L.; Maraviglia, B.; Moss, F. E. (Univ., Rome). Phys. Rev. Lett., 17: 682-4(Sept. 26, 1966).

An experiment is described which demonstrates the existence of a small potential barrier to the extraction of negative ions (excess electrons) from liquid helium into the vapor. (M.O.W.)

**44557** HEAT CAPACITY OF $\alpha$ URANIUM AT A PRESSURE OF 10 kbar, BETWEEN 0.3 AND 6°K. Ho, James C. (Univ. of California, Berkeley); Phillips, Norman E.; Smith, T. F. Phys. Rev. Lett., 17: 694-6(Sept. 26, 1966).

The heat energy capacity of $\alpha$ uranium was measured at a pressure of 10 kbar between 0.3 and 6°K both in zero magnetic field and at 2000 Oe. A heat-capacity anomaly typical of a bulk superconducting transition was observed at 2°K. These measurements constitute the first observation of bulk superconductivity in $\alpha$ uranium and show that 10 kbar increases $T_c$ by a factor of at least 20. (M.O.W.)

**44558** MAXIMUM LOSSLESS CURRENT IN A SUPERCONDUCTING FOIL WITH A SURFACE SHEATH. Fink, H. J. (Atomics International, Inc., Canoga Park, Calif.). Phys. Rev. Lett., 17: 696-700(Sept. 26, 1966).

The maximum lossless transport current density of the superconducting surface sheath of a long foil of rectangular cross section is controlled by the larger dimension 2a of the cross section when the applied magnetic field is parallel to 2a and perpendicular to the current. When 2a becomes very large the maximum current density becomes very small. (auth)

**44559** THE TRANSITION TEMPERATURE OF SUPERCONDUCTING TECHNETIUM–RHENIUM ALLOYS. Niemiec, J.; Trojnar, E. (Inst. of Structural Research and Low Temperature Lab., Polish Academy of Sciences, Wroclaw). Phys. Status Solidi, 17: K89-90(Sept. 1, 1966).

The transition temperature of Tc–Re alloys was determined by measuring the trapped flux remaining in the superconducting sample after removal of the external magnetic field. A plot of the results shows that the transition temperature decreases monotonically with increasing content of Re from 8.35°K for pure Tc to 1.699°K for pure Re. (A.G.W.)

**44560** SUPERCONDUCTING FLUXLINE PINNING BY TWIN BOUNDARIES. Van Gurp, G. J. (Philips Research Labs., Eindhoven, Netherlands). Phys. Status Solidi, 17: K135-7(Sept. 1, 1966).

The superconducting critical current of an In–20 at. % Tl crystal was measured in a constant perpendicular magnetic field as a function of the orientation of the crystal with respect to the field. Comparison of the results with results of metallographic examination of the crystal microstructure indicates that twin boundaries give rise to maximum pinning when flux lines are parallel to them and that a smaller spacing between boundaries causes more pinning, resulting in a larger critical current. (A.G.W.)

**44561** OSCILLATIONS IN THE VOLTAGE BETWEEN TWO WEAKLY CONNECTED CURRENT-CARRYING SUPERCONDUCTORS AS A FUNCTION OF THE APPLIED MAGNETIC FIELD. de Bruyn Ouboter, R.; Omar, M. H.; Arnold, A. J. P. T.; Guinau, T.; Taconis, K. W. (Kamerlingh Onnes Laboratorium, Leiden). Physica, 32: 1448-58(Aug. 1966).

The behavior of two weak contacts between two superconductors in the resistive region has been studied when currents above the critical value are applied. A periodic structure of sinusoidal shape is observed in the d-c voltage measured across the weak contacts as a function of the applied magnetic field. A model is proposed to explain the observed phenomena. (auth)

**44562** PROSPECT OF EMPLOYING CONDUCTORS AT LOW TEMPERATURE IN POWER CABLES AND IN POWER TRANSFORMERS. Wilkinson, K. J. R. (Associated Electrical Industries Ltd., Rugby, Eng.). Proc. Inst. Elec. Eng. (London), 113: 1509-21(Sept. 1966).

An estimate is made in economic terms of power that could be saved if the conductor in a 760-MVA, 275-kv a-c cable were alternatively: niobium at 4°K, aluminum at 20°K, and beryllium at 77°K. The first of these metals is a soft superconductor, and the others, if sufficiently pure, are assumed to exhibit resistivities of $3 \times 10^{-9}$ and $2 \times 10^{-8}$ Ω cm, respectively. The analysis takes into account the effects of eddy currents at these resistivities and considers the spacing of refrigerating units along the cable and the distribution of refrigerants in order to minimize that part of the cost that stems from refrigeration. A 570-MVA generator transformer with aluminum at 20°K and resistivity $3 \times 10^{-9}$ Ω cm, or alternatively, a hypothetical metal at 77°K and resistivity $2 \times 10^{-8}$ Ω cm, as the winding conductor, was studied. It is indicated that these metals would both have to be used in the form of foil and expressions are derived for three components of foil loss. Comparisons are then made of the possible saving in conductor loss with the drive power used by the refrigerators and with the cost of refrigeration plant. It is found that neither in power transmission by cable nor in power-transformer windings is there any promise of a net saving over conventional costs that would warrant the constructional and operation complexities entailed in deep refrigeration. (auth)

**44563** QUANTIZATION OF MACROSCOPIC MOTIONS AND HYDRODYNAMICS OF ROTATING HELIUM II. Andronikashvili, E. L.; Mamaladze, Yu. G. (Inst. of Physics, Academy of Sciences, Tbilisi, USSR). Rev. Mod. Phys., 38: 567-25(Oct. 1966).

A review is presented of experimental data and theoretical studies devoted to the rotating helium II problem. The problem arose when helium II appeared to be rotating as a whole in a uniformly rotated container, while dragging of its superfluid component into rotation of a cylindrical vessel seemed impossible due to the absence of viscosity and Landau's requirement curl $v_s = 0$. Later it was found that imitation of a solid body rotation by helium II is realized by means of Onsager-Feynman's vortex lines which possess quantized circulation. In a uniformly rotating vessel they are distributed approximately uniformly along its cross section, aligned parallel to the axis of rotation, and cause a complicated velocity distribution at which curl $v_s = (2\pi\hbar/m) \Sigma_v \delta(r - r_v)$, that is, Landau's requirement is valid everywhere excluding singular lines where the curl is equal to infinity ($r_v$ is a two-dimensional radius vector of a vortex line in an arbitrary plane perpendicular to the axis of rotation). Experiments are described in which both an averaged picture of the joint rotation of the superfluid and the normal components is displayed and the studies in which the existence of vortex peculiarities is manifested in a clear manner. The measurements of the meniscus of rotating helium II and its angular momentum belong to the first group of these experiments ("integral" ones). Propagation of second sound, oscillations of solid bodies immersed into helium II, passage of negative ions, and different relaxation processes (acceleration and deceleration of the vessel, changes of temperature, etc.) form the second group ("local" experiments). The experiments in which the superfluid performs potential rotation, which can be persistent in the vessel at rest are also described. Vortex lines are absent there and the circulation of velocity can reach the value equal to a lot of elementary circulations. Special attention is devoted to the problem of the nature of the phase transition helium I–helium II (and back) in the state of rotation. The properties of rotating helium II illustrate brightly the main peculiarity of a quantum liquid, i.e., its complete inability to perform nonpotential motions. They show that Landau's requirement curl $v_s = 0$ remains valid even when the thermodynamical condition of the free-energy ($E - L\omega_0$) minimization gives preference to the velocity distribution of the type $v = \omega_0 r$. (auth)

**44564** METHOD FOR RAPIDLY REVERSING MAGNETIC FIELD IN SHORTED SUPERCONDUCTING COIL. Harding, John T. (California Inst. of Tech., Pasadena). Contract NAS 7-100. Rev. Sci. Instrum., 37: 1350-1 (Oct. 1966).

A shorted superconducting coil carrying a persistent current can be made to reverse its field in less than 5 msec by subjecting the coil to an increasing external reverse field. The superconducting coil opposes a change in its interior field until its critical current is exceeded, whereupon rapid extinction of the persistent current occurs thus admitting the external field. (auth)

**44565** OBSERVATIONS OF GAPLESS SUPERCONDUCTIVITY INDUCED BY METALLIC CONTACT. Claeson, T.; Gygax, Suso (Univ. of California, San Diego, La Jolla). Solid State Commun., 4: 385-9(Aug. 1966).

Measurements of tunneling into superimposed superconducting-normal films are presented. Conductance vs voltage curves are much more smeared out than in the BCS case but are in good agreement with curves calculated from the theory of Fulde and Maki. These experiments demonstrate the existence of a pair breaking mechanism induced by metallic contact. (auth)

**44566** INFLUENCE OF LATTICE STRUCTURE ON SUPERCONDUCTIVITY IN THALLIUM. Gey, Wolfgang (Cornell Univ., Ithaca, N. Y.). Solid State Commun., 4: 403-6(Aug. 1966). (NYO-3029-8).

The influence of lattice structure on the superconducting transition temperature has been isolated experimentally in two crystallographically simple structures of thallium: the fcc phase shows about a 25% lower transition temperature than the hcp counterpart. Additional data on $\Theta_D$ and the electrical resistivity are presented for both phases. (auth)

**44567** ON THE SUPERCONDUCTIVITY OF DOUBLE LAYERS OF Ag-Sn. Steglich, Frank (Univ., Goettingen, Ger.). Z. Phys., 195: 239-51(1966). (In German).

Superimposed films of Ag and Sn are produced on suitable conditions of condensation, so that diffusion between the layers is prevented (the condensation temperatures of Ag and Sn are 320°K and 150°K, respectively). Immediately after condensation the films are cooled to liquid helium temperature, and the transition temperatures of superconductivity are measured. These values are in agreement with a phenomenological theory of P. and R. Hilsch for sufficient thick films. Resistance measurements indicate that an alloy of Ag and Sn is formed above 280°K. There is only a small shift of transition temperature caused by the alloying process. (auth)

**44568** EFFECT OF HIGH PRESSURE ON THE SUPERCONDUCTING TRANSITION TEMPERATURE OF THE ALLOYS 90Mo-10Re AND 75Nb-25Mo. Brandt, N. B.; Ginzburg, N. I. (Moscow State Univ.). Zh. Eksp. Teor. Fiz., 51: 59-61(July 1966). (In Russian).

The effect of pressures up to 28000 atm on the superconducting transition temperature $T_k$ of the alloys 90Mo-10Re and 75Nb-25Mo is investigated. It is found that in the 75Nb-25Mo alloy $T_k$ decreases under uniform pressure whereas in 90Mo-10Re it increases. The results obtained are compared with the variation of the state density on the Fermi surface N(0) during compression. (auth)

**44569** DE HAAS-VAN ALPHEN EFFECT IN ANTIMONY AT ULTRALOW TEMPERATURES. Brandt, N. B.; Minina, N. Ya.; Chu, Cheng Kang (Moscow State Univ.). Zh. Eksp. Teor. Fiz., 51: 108-17(July 1966). (In Russian).

The angular dependences of the period and the temperature dependences of the quantum oscillation amplitude of the magnetic susceptibility of antimony are investigated for two principal orientations of the crystals at helium (4.2 to 1.5°K) and ultralow (0.08 to 0.1°K) temperatures in a magnetic field up to 19 kOe. A deviation of the isoenergy surface of antimony from an ellipsoidal shape which does not exceed 10% and which is in accordance with the work of Windmiller and Priestley is found. The possible nature of the deviation is discussed. A pronounced deviation of the effective masses from proportionality to the respective extremal cross sections is noted which indicates that the electron and hole dispersion law greatly differs from a quadratic law. (auth)

**44570** THEORY OF SUPERCONDUCTOR TUNNELING. Svidzinskii, A. V.; Slyusarev, V. A. Zh. Eksp. Teor. Fiz., 51: 177-82(July 1966). (In Russian).

A kinetic approach to the theory of the tunnelling effect in superconductors is proposed. The approach permits one to develop the theory of the nonstationary Josephson current. Conditions for appearance of a non stationary current are considered and physical interpretation of the effect is presented. (auth)

**44571** ELECTRODYNAMICS OF THE JOSEPHSON EFFECT. Ivanchenko, Yu. M.; Svidzinskii, A. V.; Slyusarev, V. A. (Physico-Technical Inst. of Low Temperatures, Academy of Sciences, Ukrainian SSR). Zh. Eksp. Teor. Fiz., 51: 194-200(July 1966). (In Russian).

The magnitude and position of the resonance maxima on the curve for the constant component of the Josephson tunnelling current is calculated. The theory is based on the taking into account of the electromagnetic field of the Josephson current and of the conditions of inclusion of the tunnel transition in the external electric circuit. (auth)

**44572** TUNNELING CURRENT IN A TRANSVERSE MAGNETIC FIELD. Arcnov, A. G.; Pikus, G. E. (Inst. of Semiconductors, Academy of Sciences, USSR). Zh. Eksp. Teor. Fiz., 51: 281-95(July 1966). (In Russian).

It is shown that in the case of a strong electric field a two-band equation should be employed for analyzing the motion of electrons in crossed electric and magnetic fields $E_x$ and $H_z$. In the simplest case this equation differs from the Dirac equation in only one respect, the limiting velocity not being c but $s = (\epsilon_g/2m)^{1/2}$. For $sH_z/cE_x < 1$ the electron motion is infinite just as in the case $H_z = 0$. Decrease of the tunnelling current is then due to decrease of the effective field $E = (E_x^2 - s^2H_z^2/c^2)^{1/2}$. For $sH_z/cE_x \geq 1$ the electron motion is finite and direct transitions in an homogeneous electric field are forbidden by the energy and momentum conservation laws. The effect of a magnetic field and deformation on the current in crystals of the PbTe, PbSe and PbS type are considered, the constant energy surfaces being ellipsoids. The results of the calculations are compared with the experimental data of Rediker and Calawa for PbTe. (auth)

**44573** TUNNELING BETWEEN TWO SUPERCONDUCTORS. Ivanchenko, Yu. M. (Don Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksp. Teor. Fiz., 51: 337-44(July 1966). (In Russian).

Equations describing the behavior of a system consisting of two superconductors divided by a thin dielectric layer are derived. It is shown that the Josephson current essentially does not depend on the phase difference of the two superconductors since the parameter it depends on is involved in tunneling processes occurring even between normal metals. Some differential relations are deduced for small stresses on the barrier and for slowly varying processes. It is found that during tunneling between thin superconducting films the dependence of the tunnel current on the magnetic field strength may strongly differ from the corresponding dependence for massive samples. This is due to the fact that the currents flowing along the films become comparable with the tunnel current in relatively strong magnetic fields. (auth)

**44574** CRITICAL FIELDS OF THIN SUPERCONDUCTING FILMS. II. SPECULAR REFLECTION, VERY THIN FILMS. Shapoval, E. A. (Moscow State Univ.). Zh. Eksp. Teor. Fiz., 51: 669-79(Aug. 1966). (In Russian).

The critical fields of thin films were found in the case of specular reflection of electrons from a surface. Very thin films were considered for which quantization of the electron momentum projection on a direction perpendicular to the film plane is important near the transition temperature. Pure films as well as films containing arbitrary impurity concentrations were investigated in detail. The analysis was performed for the complete temperature range. (auth)

**44575** ON THE BOUNDARY CONDITION OF THE JOSEPHSON EFFECT. Larkin, A. I.; Ovchinnikov, Yu. N.; Fedorov, M. A. (Inst. of Physics and Tech., Moscow). Zh. Eksp. Teor. Fiz., 51: 683-7(Aug. 1966). (In Russian).

A boundary condition for the Josephson effect was obtained in the quasiclassical approximation from the Gorkov equations. The results of the investigation were in agreement with those of previous ones in which the effects were considered on basis of the tunneling Hamiltonian. (auth)

## Neutron Physics

### *See also* REACTOR TECHNOLOGY — Criticality Studies

*Refer also to abstracts 45060 and 45092.*

**44576** (CONF-660303, pp 122-33) POLYETHYLENE DOUBLE DIFFERENTIAL INELASTIC SCATTERING CROSS SECTIONS FOR EPITHERMAL NEUTRONS. Kirouac, G. J.; Moore, W. E.; Seemann, K. W.; Yeater, M. L. (Rensselaer Polytechnic Inst., Troy, N. Y.).

As part of a program to study neutron interactions with reactor moderators, scattering cross sections were measured for polyethylene at three angles (25°, 60°, and 90°) and nine incident neutron energies between 0.15 ev and 1.8 ev. Banks of proportional counters filled with $^3$He at 10 atm were located 1.85 m from the sample to detect the scattered neutrons. Cross sections were determined relative to a vanadium scattering target and the scattering law was constructed. (auth)

**44577** (CONF-660303, pp 304-8) USE OF INTEGRAL MEASUREMENTS AS SUPPLEMENTARY DATA FOR DETERMINING NEUTRON CROSS-SECTIONS. Rakavy, G. (California Inst. of Tech., Pasadena).

A generalized least-squares procedure is developed to systematically improve neutron cross section data by using the accurate data from critical mass measurements along with data on neutron spectra in critical and subcritical assemblies and direct measurements of cross sections. The cross sections thus obtained are expected to yield very accurate results in reactor calculations, at least in systems which are not too different from the ones included in the least-square analysis. The method can also be used to check the consistency of measurements on various critical and subcritical assemblies with each other and with the available cross-section data. (S.F.L.)

**44578** (CONF-660303, pp 335-53) COMPILATION, EVALUATION, AND REDUCTION OF NEUTRON DIFFERENTIAL SCATTERING DATA. Davis, S. K. (Atomics International, Canoga Park, Calif.).

A project is described in which available data on angular distributions of elastically scattered neutrons have been evaluated and reduced into forms convenient for computer calculations. This scattering data are represented by expansions in a finite series of Legendre polynomials with energy-dependent coefficients in the center-of-mass system. Several areas are pinpointed in which the standard methods of presenting and analyzing experimental data are unsatisfactory. The effect on some neutronic calculations of using an insufficient number of Legendre coefficients to represent the angular data is illustrated. (S.F.L.)

**44579** (CONF-660303, pp 532-53) NEUTRON FLUX SPECTRAL DETERMINATION BY FOIL ACTIVATION. McElroy, W. N.; Berg, S.; Gigas, G. (Atomics International, Canoga Park, Calif.).

An advanced analytical technique has been applied to several different types of neutron environment to obtain neutron flux spectra. The mathematical procedure involves selection of an initial spectral approximation and its subsequent perturbation to obtain a best-fit simultaneous solution for a system of ten or more activation integral equations. These analytical studies support earlier results that integral neutron flux may be obtained from foil data with accuracies to within ±10% to ±30% at any point over the energy range from $4 \times 10^{-7}$ to 18 Mev, if the activation cross section data and measured activation rates are accurate to ±10%. (auth)

**44580** (CONF-660303, pp 782-95) ADEQUACY OF FAST AND INTERMEDIATE CROSS SECTION DATA FROM MEASUREMENT OF NEUTRON SPECTRA IN BULK MEDIA. Russell, J. L. Jr.; Profio, A. E. (General Dynamics Corp., San Diego, Calif. General Atomic Div.).

Methods used to calculate intermediate neutron spectra in fast reactors are suspect because of inadequacies in cross section data as well as in approximations used in preparing (group averaging) cross section data for transport codes. Direct measurement of neutron spectra in bulk media provides a means of evaluating discrepancies. The status of spectra measurements is reviewed, preliminary results are discussed, and some new measurement concepts are described. (auth)

**44581** (CONF-660303, pp 1055-63) PROTON ACCELERATORS AS SOURCES OF SLOW NEUTRONS. Zucker, A. (Oak Ridge National Lab., Tenn.).

Proton accelerators in the 50 Mev to 1 Bev range are examined as sources of pulsed neutrons. Figures of merit are given for the Karlsruhe isochronous cyclotron and the Nevis synchrocyclotron. Under present operating conditions they are $4.8 \times 10^{29}$ and $2.4 \times 10^{28}$, respectively. By raising the energy and with other improvements the figure of merit for an isochronous cyclotron can reach $2 \times 10^{32}$, while for a synchrocyclotron it approaches $4.3 \times 10^{30}$. The separated orbit cyclotron compared on the same basis has a figure of merit equal to $1.8 \times 10^{33}$. The figure of merit is defined as the number of neutrons per second produced in a pulse, divided by the pulse width, and multiplied by the repetition rate. (auth)

**44582** (NAA-SR-11963) EFFECTIVE GROUP ABSORPTION CROSS-SECTIONS AND RESONANCE OVERLAP. Fillmore, F. L. (Atomics International, Canoga Park, Calif.). July 15, 1966. Contract AT(11-1)-Gen-8. 46p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The effect of resonance overlap on multigroup resonance cross sections and the Doppler coefficient is examined. Consistent definitions are given for the group flux and effective cross section using both the TRUE FLUX and the 1/E FLUX methods. Approximate expressions are developed for the effective resonance absorption cross section in a homogeneous mixture. The validity of the approximations is discussed for typical fast reactor cores, and an example is presented of a correction for self-overlap. The calculation of reactivity coefficients by means of first-order perturbation theory is interpreted, and it is shown that the same result is obtained with either the TRUE FLUX or the 1/E FLUX method of defining the effective cross sections; however, the TRUE FLUX method is the one recommended. Approximate expressions for the change in the effective absorption cross section due to Doppler broadening of resonances are developed, and consideration is given to the effect of resonance overlap on this change in the effective cross section. It is concluded that the error in the Doppler coefficient for typical fast reactor cores due to neglecting resonance overlap should usually not exceed a few percent provided that the TRUE FLUX definitions are used for the effective cross sections. It is recognized, however, that situations may exist where the neglect of resonance overlap is not justified. (auth)

**44583** (NAA-SR-11980(Vol.1)) COMPILATION, EVALUATION AND PRODUCTION OF NUCLEAR DATA FOR REACTOR CALCULATIONS. Alter, Harry; Dunford, Charles L. (Atomics International, Canoga Park, Calif.). Aug. 15, 1966. Contract AT(11-1)-Gen-8. 36p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A system for the evaluation and processing of nuclear data is briefly described, and some improvements in methods of evaluation of nuclear data are recommended. (D.C.W.)

**44584** (NAA-SR-11980(Vol.3)) GRISM: A CODE TO GENERATE MULTIGROUP CONSTANTS FROM MICROSCOPIC NEUTRON CROSS SECTION DATA. Lewis, R. C.; Blaine, R. A.; Fillmore, F. L.; Lemke, B. J.; O'Reilly, B. D.; Otter, J. M. (Atomics International, Canoga Park, Calif.). Sept. 15, 1966. Contract AT(11-1)-Gen-8. 86p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Input data from the Atomics International Evaluated Nuclear Data File (AIENDF) tape are processed to give spectrum-weighted group-averaged neutron cross sections and other quantities required for the solution of the neutron transport equation by multigroup diffusion and transport theory methods. The calculation of multigroup Doppler-broadened effective resonance integrals and cross sections in the resonance region for a heterogeneous or homogeneous resonance absorber is based on the single-level Breit-Wigner theory with no overlapping of neighboring resonances. Inelastic and elastic scattering transfer matrices are calculated using differential scattering cross section data stored on the AIENDF Angular Distribution

Data Tape (ADDT). Multigroup libraries are punched in any of the formats required by the one-dimensional multigroup diffusion theory codes, ULCER, FAIM, FAIM-CELL, CAESAR, and CAESAR IV; the one-dimensional multigroup $S_n$ transport theory code, DTF; and the spectrum codes, FORM and AILMOE. (auth)

**44585** (NAA-SR-Memo-11866) COLD NEUTRON EFFECTS IN GRAPHITE DIFFUSION MEASUREMENTS. DeJuren, J. A.; Swanson, V. A. (Atomics International, Canoga Park, Calif.). Mar. 1, 1966. Contract AT(11-1)-Gen-8. 23p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Diffusion length measurements were made in AGOT graphite as a function of transverse buckling. For bucklings greater than $3.5 \times 10^{-3}cm^{-2}$, spectral equilbrium is not attained between a predominantly thermal neutron group and a cold neutron group beyond the Bragg cutoff. The presence of cold neutrons cause a distinct increase in the measured extrapolation length. A treatment is given for the variation of the steady-state diffusion length with buckling for a Maxwellian spectrum whose temperature is modified by leakage. (auth)

**44586** (NAA-SR-Memo-12019) AN ADAPTATION OF THE ORNL M-GAM CODE FOR USE AT ATOMICS INTERNATIONAL. (NAA PROGRAM DESCRIPTION). Morgan, J. G.; Blaine, R. A. (Atomics International, Canoga Park, Calif.). Mar. 1966. Contract AT(11-1)-Gen-8. 53p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

A consistent $P_1$ multigroup code for the calculation of fast-neutron spectra and multigroup constants is described. The maximum number of fast groups allowed is 68. A large library tape is used with this code. (auth)

**44587** (NP-16291) NEUTRON SCATTERING AND THERMALIZATION LECTURES. Purohit, S. N. (Aktiebolaget Atomenergi, Stockholm (Sweden)). May 1965. 160p. (S-333). Dep. mn.

Four lectures on selected topics of neutron scattering are presented. They discuss (1) scattering law formalism, (2) incoherent scattering laws and width functions, (3) Zemach-Glauber treatment for molecules, and (4) scattering laws for liquid moderators ($H_2O$ and $D_2O$). In addition, five other lectures dealing with topics of present interest in neutron thermalization studies with a special emphasis on the applications of the matrix elements of the scattering operator are included. (M.O.W.)

**44588** (ORNL-TM-1484) IMPORTANCE SAMPLING DEVICES FOR SELECTING TRACK LENGTHS AND DIRECTIONS AFTER SCATTER IN 05R. Clark, F. H.; Betz, N. A. (Oak Ridge National Lab., Tenn.). Aug. 5, 1966. Contract W-7405-eng-26. 17p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Several importance sampling schemes are discussed in detail. A path-length stretching scheme and an exponential transform scheme, both available in the 05R Monte Carlo code, are described analytically and by means of listings and flow charts. A scheme to adapt these two schemes to "never-escape selection," not available in 05R, is described analytically only. A scheme for biased selection of laboratory direction after scatter, available in 05R, is described analytically only. This last scheme, unlike the others, has not led to good results in any test. (auth)

**44589** (WANL-TME-1472) GAM-TNS CROSS SECTION LIBRARY FOR THE n+W REACTIONS. Gibson, Gordon; Melnick, M. (Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.). July 22, 1966. Contract SNP-1. 88p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

The neutron cross sections for $^{182}W$, $^{183}W$, $^{184}W$, and $^{186}W$, which were added to the GAM-TNS library, are plotted and are tabulated. Resonance parameters and scattering matrices are also included. The energy range from 0 to 10 Mev is covered. The preparation of the data is discussed. (D.C.W.)

**44590** (WAPD-T-1802) SEVEN-POINT DIFFERENCE EQUATIONS WITH ARBITRARY MESH SPACING FOR NEUTRON DIFFUSION IN 60 DEG GEOMETRY BY THE INTEGRATION TECHNIQUE. Gast, R. C. (Bettis Atomic Power Lab., Pittsburgh, Pa.). Jan. 20, 1965. Contract AT(11-1)-Gen-14. 24p. (CONF-650602-88). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From American Nuclear Society 11th Annual Meeting, Gatlinburg, Tenn.

Two derivations are presented for two-dimensional, seven-point difference equations for neutron diffusion in 60° geometry with arbitrary mesh spacing by the integration technique. The first derivation defines a class of difference equations which contains a seven-point difference equation for arbitrary mesh which is simpler than those presently used. The second derivation results in a simple seven-point difference equation which is of special interest since a positive guarantee against negative flux can be given. (S.F.L.)

**44591** SCATTERING OF SLOW NEUTRONS BY ORTHO- AND PARAHYDROGEN. Atanasov, A. A.; Ivanov, K. I. (Higher Pedagogical Inst., Plovdiv, Bulgaria). Acta Phys. Pol., 30: 323-30(Aug. 1966).

The scattering of slow neutrons by ortho- and parahydrogen is treated on the basis of Fadeev's equations. In cases when the Fermi potential is used, the problem is reduced to the solution of a system of 16 integral equations. (auth)

**44592** NON-PULSED TIME-OF-FLIGHT NEUTRON SPECTROMETER. Furuta, Junichiro; Fujishiro, Masatosi; Azuma, Toshio. Ann. Rep. Radiat. Center Osaka Prefect., 6: 87-9(1965).

A new type of neutron spectrometer was tried on the principle of time-of-flight which is a suitable technique for determination of intermediate energies of neutrons. No pulsing mechanism of neutron sources is necessary, though the efficiency is sacrificed, and higher energy resolution can be expected with finer electronics techniques. A new spectrometer and a preliminary measurement of the neutrons from Am-Be are described. (auth)

**44593** ON THE DERIVATION OF THE VAN HOVE-GLAUBER FORMULA FOR THE SCATTERING OF THERMAL NEUTRONS BY A SYSTEM OF ATOMIC NUCLEI. Goodman, B.; Waller, I. Ark. Fys., 32: 537-40(1966).

A derivation is given of the van Hove-Glauber formula for the scattering of thermal neutrons by a system of nuclei by applying methods which are connected with the Wiener-Khintchine Theorem for random processes. This derivation maintains a close connection with the classical picture of the scattering. (auth)

**44594** REVISION OF THE HARWELL $^{240}Pu$ SOURCE STRENGTH AND $\bar{\nu}$ FOR $^{235}U$ AND $^{252}Cf$. Fieldhouse, P. (Atomic Weapons Research Establishment, Aldermaston, Eng.); Culliford, E. R.; Mather, D. S.; Colvin, D. W.; MacDonald, R. I.; Sowerby, M. G. J. Nucl. Energy: Pt. A and B, 20: 549-55(July 1966).

There is now strong evidence that the intensity of the Harwell $^{240}Pu$ neutron standard is some 2% lower than the value of $(2.036 \pm 0.030) \times 10^4$ n/sec quoted in the original calibration and relative to which $\bar{\nu}$ $^{252}Cf$ (spontaneous) and $\bar{\nu}$ $^{235}U$ (thermal) have been determined. (auth)

**44595** NOTE ON THE EVALUATION OF $(v\Sigma_s)_{min}$ FOR THE EFFECTIVE WIDTH MODEL. Williams, M. M. R. (London Univ.). J. Nucl. Energy: Pt. A and B, 20: 587-8(July 1966).

A brief outline is given of the derivation of $(v\Sigma_s)_{min}$ for the effective width model, using a method suggested by Kuscer and Corngold to obtain the quantity in closed form. (L.B.S.)

**44596** THE INSTALLATION OF A 14 Mev NEUTRON GENERATOR. Darrall, K. G.; Oldham, G. Nucl. Energy, 189-94(July-Aug. 1966).

A 14-Mev neutron generator is described which constitutes a reasonably compact, safe unit capable of producing up to $2 \times 10^9$ neutrons per square cm per second with reasonable homogeneity across the target. The system is almost entirely automatic and can be operated by laboratory staff after a short training period. The function of the generator, shielding, sample transfer system, measurement system, automatic analysis system, and operating performance are discussed. (L.B.S.)

**44597** MANIAC: A COMPUTER CODE FOR CORRECTING NEUTRON SCATTERING ANGULAR DISTRIBUTIONS. **Bevington, P. R.** (Duke Univ., Durham, N. C. Stanford Univ., Calif.). **Nucl. Instrum. Methods, 44: 341-4(Oct. 1966).**

MANIAC is a Fortran computer code which uses a Monte Carlo technique to simulate the scattering of neutrons by right cylindrical targets to calculate the effects of geometry, attenuation of neutron flux, and multiple scattering for finite targets. Single scattering events are simulated exactly. Multiple scattering is approximated by modifying the yield of double scattering. The program is fast and highly efficient and compact enough to be used with 8000 word real-time computers. (auth)

**44598** COLD NEUTRON SCATTERING BY LIQUID NITROGEN. **Teutsch, H.; Mateescu, N.; Nahorniak, V.; Diaconescu, A.** (Inst. of Atomic Physics, Bucharest). **Phys. Lett., 22: 558-60(Sept. 15, 1966).**

The dispersion law for the quasi-phonons in liquid nitrogen is derived from the measurements of neutron scattering on liquid nitrogen. (auth)

**44599** NEUTRON SCATTERING FROM GASEOUS METHANE AND AMMONIA. **Venkataraman, G.; Rao, K. R.; Dasannacharya, B. A.; Dayanidhi, P. K.** (Atomic Energy Establishment, Trombay, India). **Proc. Phys. Soc. (London), 89: 379-83(1966).**

The scattering of cold neutrons by gaseous methane and ammonia at room temperature was calculated treating the rotations in a quantum-mechanical fashion. Comparison with the experimental data of Webb showed good agreement at large scattering angles and a small discrepancy at forward angles. (auth)

**44600** NEUTRON GENERATOR. **Iwashita, Fumio** (to Tokyo Shibaura Electric Co., Ltd.). **Japanese Patent 1965-26960. Sept. 13, 1965. Filed Dec. 30, 1964.**

A neutron generator that features improved control of the voltage sources that are used to control the deuteron beam is proposed. (D.C.W.)

## Nuclear Properties and Reactions

*Refer also to abstracts 43387, 43419, 43460, 43684, 43702, 43717, 43764, 44076, 44194, and 44231.*

**44601** (ANL-7218) PHYSICS DIVISION SUMMARY REPORT, MAY 1966. **(Argonne National Lab., Ill.). Contract W-31-109-eng-38. 26p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.**

A comparison was made of the relative spectroscopic factors from ($^{3}$He,d) reactions with those from (d,n) reactions for the low T = 0 and T = 1 states in the odd-odd nuclei $^{10}$B, $^{14}$N, and $^{26}$Al. In each case a smaller value of the relative spectroscopic factor for the states with isobaric spin T = 1 is deduced from the (d,n) reaction than from the ($^{3}$He,d) reaction, the spectroscopic factors being normalized to the T = 0 ground states for the two reactions. (S.F.L.)

**44602** (BNL-982) CROSS SECTIONS FOR TRANSURANIUM ELEMENT PRODUCTION. **Pearlstein, S.** (Brookhaven National Lab., Upton, N. Y.). **May 1966. Contract AT(30-2)-Gen-16. 58p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.**

An evaluation of cross sections useful for determining the production of transuranium elements is presented. The measured thermal cross sections and resonance integrals for the heavy elements beginning with $^{234}$U were collected. Resonance parameters reported in BNL-325 were used in a single-level formalism to reconstruct the total and partial neutron cross sections as a function of energy for the nuclides $^{236}$U, $^{237}$Np, $^{238}$Pu, $^{240}$Pu, $^{241}$Pu, $^{242}$Pu, $^{241}$Am, $^{243}$Am, and $^{244}$Cm. A single scattering radius, adjusted for best fit in the valleys between resonances, was used and a 1/v background cross section added to account for the low-energy tails of the unresolved resonances. Good fits to the measured total and partial cross sections were observed throughout the resolved resonance region for most nuclides, but strong resonance-resonance interference effects were noted for $^{241}$Pu. An integral over energy of the product of the absorption or fission cross section and a 1/E flux from a low energy limit of 0.55 ev was calculated as a function of energy in the resolved resonance region. An extrapolation to high energies allowed comparison with measured resonance integrals. Good agreement between extrapolated resonance integrals and measurements was noted for all cases except $^{238}$Pu and $^{237}$Np. Information is reported on the capture integrals of $^{241}$Pu, $^{241}$Am, and $^{244}$Cm and the fission integral of $^{241}$Am. (auth)

**44603** (CONF-660303) CONFERENCE ON NEUTRON CROSS SECTION TECHNOLOGY, MARCH 22-24, 1966, WASHINGTON, D. C. **Hemmig, P. B. (ed.)** (Atomic Energy Commission, Washington, D. C.). **1098p. Dep. mn. CFSTI $11.25 cy, $4.25 mn.**

This report issued in two books, but cataloged as a unit. Separate abstracts were prepared for 46 of the 89 papers included. For remaining papers, see items under CONF-660303 in the report-number index. (S.F.L.)

*For abstracts of individual papers see: 44576-44581, 44604-44632, 45064-45071, 45107, 45192, and 45193.*

**44604** (CONF-660303, pp 67-74) PROBLEMS ASSOCIATED WITH THE ANALYSIS OF TOTAL CROSS SECTION DATA OF RADIOACTIVE SAMPLES. **Simpson, Ferrol B.** (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

A somewhat different approach must be used in analyzing total cross section measurements taken on radioactive samples because of the contaminants that grow into the sample as a function of time. If the half life of the sample material is short, the decay products can require that sizable corrections be made. In order to take this effect into account, a program has been written which enables one to fit the transmission of the composite data. The technique allows the use of any combination of the Breit-Wigner single level, Reich-Moore multilevel, or Adler multilevel formulas. The first measurements taken on a radioactive sample give thick sample data (low transmissions); measurements taken on the same sample at later times give thin sample data (high transmission). (auth)

**44605** (CONF-660303, pp 182-203) THE NEUTRON CAPTURE CROSS SECTION OF THE TUNGSTEN ISOTOPES FROM 0.01 TO 10 ELECTRON VOLTS. **Friesenhahn, S. J.; Haddad, E.; Frohner, F. H.; Lopez, W. M.** (General Dynamics Corp., San Diego, Calif. General Atomic Div.).

Capture cross section measurements from 0.01 to 10 ev on $^{182}$W, $^{183}$W, $^{184}$W, and $^{186}$W employing a total absorbing gamma-ray detector are described. The 2200 m/sec value of the capture cross section is compared with previously reported measurements, and the shape and magnitude of the cross section curve are compared with calculations using reported resonance parameters. Parameters of negative energy levels required to account for the discrepancy between measured and calculated cross sections for $^{182}$W and $^{184}$W are given. A measurement of the gold capture cross section is used as a check on the techniques employed. (auth)

**44606** (CONF-660303, pp 226-34) CROSS SECTION DATA COMPILING: PRESENT AND FUTURE. **Goldberg, Murrey D.** (Brookhaven National Lab., Upton, N. Y.).

The present status of services rendered by Sigma Center (the Neutron Cross Section Compilation Group at Brookhaven) is described. The cross section data library on magnetic tape (SCISRS) is presented, along with some of its present problems and the proposals for solution. The growing difficulties of maintaining compact presentation of cross section data in publication form are demonstrated, and the future of such publication is discussed. (auth)

**44607** (CONF-660303, pp 270-86) NEUTRON CROSS-SECTION EVALUATION BY AIDA, AUTOMATED INSPECTION OF DATA. Lemke, Barbara J. (Atomics International, Canoga Park, Calif.).

A FORTRAN IV program, AIDA, has been developed at Atomics International to aid in the evaluation of available nuclear data files. Aldermaston, Livermore Radiation Laboratory and Los Alamos, and Atomics International data files are acceptable to AIDA. The program plots selected cross-sections from one data file according to the scale, log-log or semi-log, specified by the user; or, in overlay form, from two data files according to the scale specified by the program. Up to 901 energy points can be handled. Results of cross-section evaluations, and additional features of AIDA are presented. (auth)

**44608** (CONF-660303, pp 309-14) A COMPREHENSIVE COMPUTER LIBRARY OF NEUTRON ACTIVATION CROSS SECTIONS. Klopp, D. A. (IIT Research Inst., Chicago, Ill.).

A computer library of $(n,\gamma)$, $(n,p)$, $(n,\alpha)$, and $(n,2n)$ cross sections has been constructed for use in computer calculations of neutron activation. Data for well over 200 different isotopes are represented by average cross sections for 43 neutron energy groups spanning the energy range from 21 Mev to thermal. Resonance parameters of as many as nine different resonances are tabulated for each isotope. These data have been augmented by statistical model calculations of $(n,\gamma)$ group cross sections in the unresolved resonance energy region. (auth)

**44609** (CONF-660303, pp 315-27) CROSS SECTION CALCULATIONS THROUGHOUT THE PERIODIC TABLE. Klopp, D. A. (IIT Research Inst., Chicago, Ill.).

A simple self-consistent formalism for the estimation of $(n,\gamma)$, $(n,p)$, $(n,\alpha)$, and $(n,2n)$ cross sections has been developed for use in survey calculations of neutron activation. The only required information is the Z and A of the target nucleus. The $(n,p)$, $(n,\alpha)$, and $(n,2n)$ cross sections are calculated using a statistical compound nucleus model with a Fermi gas level density. Generally good agreement has been obtained upon comparison with experimental data. Semi-empirical formulae have been constructed for the estimation of unknown thermal $(n,\gamma)$ cross sections. Epithermal $(n,\gamma)$ cross sections are estimated by a statistical resonance treatment; this method gives poor agreement with experimental data. (auth)

**44610** (CONF-660303, pp 381-403) CAPABILITIES AND LIMITATIONS OF THE TIME-OF-FLIGHT NEUTRON SPECTROSCOPY BETWEEN 100 eV AND 100 kev. Rainwater, James (Columbia Univ., New York).

The various factors involved in the measurement of neutron cross sections are described. These factors make the evaluation of the raw experimental data more complicated than might be expected with real possibility of gross error in obtaining the desired cross section information. For total cross section measurements, the principal factor is to obtain a correct evaluation of the energy and sample dependent background corrections. Carefully conceived and executed separate experiments, interlaced with the main experiment, are required. The standard plots of $\sigma$ vs E may be very misleading for the user for various reasons which are discussed. For experiments which measure scattering or capture directly, the above considerations also apply. In addition, one must also be concerned with an accurate evaluation of the detector efficiency and the neutron flux vs energy. Self shielding or multiple interactions in the scattering or capture foil must be treated correctly. Some suggested techniques are given and examples are presented of studies using the Columbia synchrocyclotron neutron velocity spectrometer. Standard analysis curves are presented which illustrate the various points. (auth)

**44611** (CONF-660303, pp 486-501) BORON CROSS SECTIONS AS A SOURCE OF DISCREPANCY FOR CAPTURE CROSS SECTIONS IN THE kev REGION. Bogart, Donald (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center).

Discrepancies in capture cross sections for gold from 80 to 200 kev are explained by changes in boron $(n,\alpha)$ cross sections used to monitor neutron fluxes. These changes in boron cross sections are shown to improve agreement in capture data for iodine, indium, silver, antimony, and tantalum. Reexamination of the boron cross section measurements discloses that a modified long counter with considerable loss in efficiency below 200 kev had been used, but its response had been taken to be flat. Boron cross sections, corrected for long counter efficiency, depart significantly from a 1/v variation above ~80 kev. (auth)

**44612** (CONF-660303, pp 562-76) RESONANCE STRUCTURE ABOVE 100 kev. Newson, H. W. (Duke Univ., Durham, N. C.).

From about 100 to 1,000 kev, resolutions already attained are sufficiently good to distinguish and measure the parameters of s- and p-wave resonances for $^{206}$Pb, $^{208}$Pb, and lighter even-even (nearly isotopically pure) targets as heavy as A = 70. (Similar analysis of the cross sections of odd-mass targets is much more difficult and only successful in special cases.) The results of such analysis are consistent with the Porter-Thomas and Wigner distributions, the sum rule for "doorway states," the supershell models of Rosenzweig and of Newson and Duncan, and the (2J+1) rule as applied to s-, p-, and possibly d-wave resonances. A discussion is given of the improvements in resolution necessary for analysis of such "magic nucleus" cross sections as those of the Zr and Ba isotopes. Recent results of strength-function measurements from averaged cross sections are discussed. The s-wave strength functions still appear to be unexpectedly low in the neighborhood of tin. The p-wave strength functions between A = 75 and 140 are in reasonably good agreement with the vibrating nucleus calculations of Buck and Perey. (auth)

**44613** (CONF-660303, pp 577-98) INELASTIC NEUTRON SCATTERING; A COMPENDIUM. Smith, A. B. (Argonne National Lab., Ill.).

Inelastic neutron scattering is considered primarily in a technological context. Pertinent experimental methods including non-elastic scattering, $(n,n'\gamma)$, and time-of-flight techniques are discussed with emphasis on present capabilities and future potential. The present state of experimental knowledge is illustrated by inelastic scattering from Al, Fe, and U. Consideration is given to the inelastic excitation of both discrete nuclear states and states forming part of the nuclear continuum. The physical interpretation of the experimental results is discussed within the framework of the optical model and Hauser-Feshbach theory including effects due to deformation and resonance width fluctuations. Predictions based upon a general optical potential are compared with a wide range of measured inelastic cross sections and it is shown that the potential provides a mechanism for extrapolating the experimental results. Finally, the effect of improved knowledge of inelastic scattering on macroscopic reactor calculations is illustrated. (auth)

**44614** (CONF-660303, pp 613-22) EFFECTS OF $(n,\gamma n')$ PROCESSES ON FAST NEUTRON CAPTURE AND NONELASTIC SPECTRA. Moldauer, P. A. (Argonne National Lab., Ill.).

An initial gamma-ray de-excitation of the compound nucleus formed in $(n,\gamma n')$ processes is followed by neutron re-emission with increasing likelihood as the incident neutron energy rises above 1 Mev. This fact plays a major role in determining the energy dependence of the capture cross section at neutron energies above 1 Mev. It also provides an important mechanism for fast neutron energy degradation that supplements inelastic scattering. The magnitudes of these effects are estimated with the aid of statistical models of the compound nucleus for iron, tantalum, thorium, and $^{238}$U. (auth)

**44615** (CONF-660303, pp 675-81) THE 14-Mev DIFFERENTIAL CROSS SECTION OF $^{93}$Nb. Western,

G. T.; Williams, J. R.; Carter, H. G. (Convair, Fort Worth, Tex.).

The differential elastic cross section of $^{93}$Nb for 14-Mev neutrons has been measured by the associated particle time-of-flight method at angles from 20° to 140°. Extrapolation using the black-core model yields a total elastic cross section of 1770 mb. The measured total cross section is 3940 mb. The substantial difference between the total-minus-elastic value of 2170 mb and the reported, measured non-elastic value of 1750 mb for Zr is considered. It is concluded that the contribution of the direct interaction component is appreciably higher than the 10% generally attributed to it. (auth)

**44616** (CONF-660303, pp 682-9) DISCREPANCY BETWEEN EXPERIMENTAL AND PREDICTED CROSS SECTIONS FOR THE $^{93}$Nb(n,2n)$^{92}$Nb REACTION. Carter, H. G. (Convair, Fort Worth, Tex.).

The 14 Mev (n,2n) cross section of $^{93}$Nb measured by activation analysis is much smaller than the value predicted by statistical model theory. In order to locate the origin of the discrepancy we have analyzed the prompt gamma yield and found it to be consistent with the statistical model predictions, although it appears that the competition from the (n,np) process is stronger than expected. The (n,2n) discrepancy is explained in terms of the formation of an $^{92}$Nb isomer with an unobservable activity. (auth)

**44617** (CONF-660303, pp 701-12) MEASUREMENT OF THE $^{6}$Li(n,$\alpha$) AND $^{10}$B(n,$\alpha$) CROSS SECTIONS BY THE SHELL TRANSMISSION METHOD. Cox, Samson A. (Argonne National Lab., Ill.).

The spherical shell transmission method was used to measure the total neutron absorption cross section for $^{6}$Li from 10.7 to 102 kev and for $^{10}$B from 10.7 to 245 kev. Measurements were made with the neutron source inside the spherical shell and detector outside and with the neutron source outside and detector inside. The $^{7}$Li(p,n) reaction was utilized as the neutron source outside the spherical shell and the $^{51}$V(p,n) reaction as the neutron source inside the spherical shell. For the measurements with the neutron source inside the spherical shell 7 moderated BF$_3$ counters were placed around the sphere to effectively integrate over the angular distribution of the neutrons from the $^{51}$V(p,n) reaction and thus to compensate for any anisotropy. After correction for finite size effects and multiple scattering, the results of the two methods were in good agreement. The final cross section for the $^{10}$B measurements were in good agreement with a 1/v extrapolation from a thermal neutron absorption of 3840 barns. The final cross section for $^{6}$Li was ~30% higher at 10.7 kev than a 1/v extrapolation from the thermal cross section of 945 barns. (auth)

**44618** (CONF-660303, pp 726-34) MEASUREMENT OF NONELASTIC CROSS SECTION FOR LEAD AT 2.1 AND 1.7 Mev. Beghian, L. E.; Hofmann, F.; Wilensky, S. (Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering).

A new method was developed to measure total nonelastic neutron cross sections in the high kev and low Mev energy range. A pulse of monoenergetic fast neutrons of several nanoseconds duration is used to excite a lead assembly. The neutron decay is measured as a function of assembly size with conventional nanosecond time-of-flight equipment. The neutron detector is biased to eliminate all nonelastically scattered neutrons. A theoretical relationship has been developed by Paik (Trans. Am. Nuc. Soc. 8: 1, 292) which relates the assembly size to the measured decay constant. The nonelastic cross section appears as a parameter in Paik's theory and can be chosen to give the best fit to the experimental data. Decay constants were measured at 2.1 and 1.7 Mev for lead assemblies 20" wide × 20" high and thicknesses from 1" to 8". Paik's theory assumes the establishment of an asymptotic spacial decay mode. This assumption was verified by measuring the neutron decay at various positions of the assembly. The results show that it takes the order of 10 to 15 ns to establish a spacial mode. (auth)

**44619** (CONF-660303, pp 755-62) SPIN MEASUREMENT OF THE 8.8 eV NEUTRON RESONANCE IN $^{235}$U BY MEANS OF THE RESONANT SCATTERING METHOD. Poortmans, F.; Ceulemans, H.; Neve de Mevergnies, M. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)).

Resonance scattering experiments on $^{235}$U targets using a monochromatic neutron source are reported. Because of the small $\Gamma_n$ values of low-energy resonances in fissile isotopes, a special scattering chamber using a $^{3}$He proportional counter was constructed, for which pulse-height discrimination was possible between fission neutrons and scattered neutrons. Scattering measurements in the 8.8 ev resonance of $^{235}$U yielded J = 3 as a preliminary result. (S.F.L.)

**44620** (CONF-660303, pp 763-5) CROSS SECTION FOR THE REACTION $^{6}$Li(n,$\alpha$)T. Barry, J. F. (Atomic Weapons Research Establishment, Aldermaston (England)).

The cross section for the reaction $^{6}$Li(n,$\alpha$)T has been measured relative to the fission cross section for $^{235}$U at neutron energies of 25, 67, and 100 kev. The ratio of the count rates in a fission chamber and a lithium-loaded ionization chamber was determined when the counters were simultaneously exposed to a flux of neutrons. Determination of this ratio for thermal neutrons, for which both the $^{6}$Li(n,$\alpha$) and $^{235}$U fission cross sections are known, enables cross sections to be obtained which are independent of the mass of material in either counter. The results help to distinguish between previous determinations of the cross section in this energy region. (auth)

**44621** (CONF-660303, pp 773-81) THE INTERPRETATION AND EVALUATION OF INTEGRAL CROSS SECTIONS BY REACTIVITY MEASUREMENTS. Scoville, J. J.; Fast, E. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

The importance of reactivity measurement of integral cross sections is discussed. The investigator should either make the measurements in a pure 1/E dependent flux, or be able to correct for any departure from this idealistic condition. Calculational methods are employed to make these, along with other possible corrections for fast fission, (n,2n′), and inelastic scattering reactions. Since many materials do not activate upon neutron absorption, the reactivity technique is important in determining their resonance integrals. Some results determined with the ARMF reactors by static reactivity measurements are included. (auth)

**44622** (CONF-660303, pp 796-808) A CRITICAL EVALUATION OF FAST FISSION CROSS SECTIONS. Davey, William G. (Argonne National Lab., Idaho Falls, Idaho).

The published cross sections of $^{235}$U, $^{238}$U, $^{239}$Pu, and $^{240}$Pu from 1 kev to 10 Mev were studied to select best cross sections for fast reactor analysis. Emphasis was placed on determining the reference data used and, where necessary, revising the measurements to accord with currently accepted cross sections. Some checks were made by comparing calculations based on the selected cross sections with integral measurements in the fission spectrum and in 19 fast reactor critical assemblies. The study shows a clear need for more work on precise fission cross sections, particularly that of $^{235}$U since it is widely used as a reference. (auth)

**44623** (CONF-660303, pp 840-72) MEASUREMENT AND ANALYSIS OF CROSS SECTIONS OF FISSILE NUCLIDES. Moore, M. S.; Simpson, O. D. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

A review is given of developments which have led to more accurate measurements of total and partial cross sections of fissile nuclides. Recent experiments which provide a more complete understanding of the fission process are also discussed. Calculations are performed to compare observed resonance behavior of $^{241}$Pu with resonances whose parameters are generated by a Monte-Carlo treatment based on fission theory. (auth)

**44624** (CONF-660303, pp 873-94) INTERPRETATIONS OF NEUTRON CROSS SECTIONS OF THE FISSIONABLE MATERIALS FOR THE RESOLVED RESONANCE REGION. Adler, F. T.; Adler, D. B. ([Illinois Univ., Urbana]).

The relations of various well-known formalisms in nuclear reaction theory are considered. Certain advantages of the Kapur-Peierls formalism for a description of low-energy cross sections of fissile nuclides in a form suitable for applications in practical reactor calculations are considered. (auth)

**44625** (CONF-660303, pp 910-18) THE FISSION CROSS SECTION OF $^{241}$Pu FROM 20-200 eV AS DETERMINED FROM A NUCLEAR EXPLOSION. Simpson, O. D.; Fluharty, R. G.; Moore, M. S.; Marshall, N. H. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

A nuclear explosion has been used as a neutron source for a measurement of the neutron-induced fission cross section of $^{241}$Pu. Over the region from 20 to 200 ev, the region of thermal neutron energies of the source, the flux was high enough to permit the determination of fission cross sections with a minimal error. A comparison of these data with previous measurements of the fission cross section of $^{241}$Pu shows that a significant improvement has been made, both in resolution and in statistical accuracy. The data below 60 ev have been analyzed with the use of a multilevel formula. (auth)

**44626** (CONF-660303, pp 919-32) TECHNIQUES FOR DETERMINING ETA FOR THE THERMALLY FISSIONABLE ISOTOPES. Smith, J. Richard; Fast, Edwin (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Several types of experiments are reviewed as to their contributions to an understanding of the fission parameter, $\eta$, the number of fission neutrons produced per absorption. The comparison of monochromatic values with spectrum-averaged values requires detailed understanding of the energy dependence involved. It is necessary to consider all evidence concerning both absolute value and energy dependence in order to obtain a consistent picture of either. (auth)

**44627** (CONF-660303, pp 933-8) MEASUREMENTS AND CALCULATIONS OF THE DOPPLER EFFECT ON THE REACTIONS $^{238}$U(n,$\gamma$), $^{235}$U(n,f) AND $^{239}$Pu(n,f) WITH NEUTRONS IN THE ENERGY RANGE 0–25 kev. Perkin, J. L.; Fieldhouse, P.; Brickstock, A.; Davies, A. R. (Atomic Weapons Research Establishment, Aldermaston (England)).

Spherical samples, 2 cm in diameter, of $^{238}$U, $^{235}$U, and $^{239}$Pu were irradiated in turn at various temperatures ranging from 170 to 770°K in a central cavity of a spherically symmetric Sb–Be photo neutron source. The $^{238}$U(n,$\gamma$) reaction rate was measured by counting the $^{239}$U activity produced, and the (n,f) reactions were monitored by counting the fission neutrons emitted. The results obtained for the dependence of reaction rate on temperature were compared with those from a computer calculation based on a program developed by Brissendon and Durston. (ANL-7050, p.51 (1965)). (auth)

**44628** (CONF-660303, pp 964-70) NEED FOR $^{238}$Pu AND $^{244}$Cm CROSS SECTION DATA. Ottewitte, Eric H.; Keshishian, Vahe (Atomics International, Canoga Park, Calif.).

Both $^{238}$Pu and $^{244}$Cm promise to be excellent radioisotope heat sources. The question of criticality arises when either of these materials is assembled in large quantity. To calculate the criticality of these systems information is required about the neutron-interaction parameters, particularly $\nu$, the number of secondary neutrons produced per fission and the fission cross section $\sigma_f$. Calculations based on theoretical estimates of $\nu$, $\sigma_f$, and the other nuclear parameters have shown remarkable agreement with material replacement experiments at LASL. There have been very few measurements for $\sigma_f$ and none for $\nu$. It is concluded that a particularly interesting measurement which might be possible would be the determination of $\nu$ from the (low decay rate) spontaneous fission of $^{239}$Pu, the compound nucleus of $^{238}$Pu. (S.F.L.)

**44629** (CONF-660303, pp 985-96) ANALYTICAL DESCRIPTIONS OF THE SUB-CADMIUM CROSS SECTION OF $^{233}$U, $^{235}$U, $^{239}$Pu, AND $^{241}$Pu. Fluharty, R. G.; Marshall, N. H.; Simpson, O. D. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.).

Simple analytical fits to the neutron absorption and fission cross sections for the fissile nuclei are presented below 0.5 ev. The coefficients of the mathematical equations are presented and should be of interest to those calculating reactor reaction rates. (auth)

**44630** (CONF-660303, pp 997-1003) A COMPARISON OF MULTILEVEL AND SINGLE LEVEL EFFECTS FOR A FISSIONABLE ISOTOPE. Pennington, E. M. (Argonne National Lab., Ill.).

A study was made of the behavior of the total and fission cross sections of two neighboring resonances in $^{235}$U, calculated using various sets of parameters in multilevel formulas. Least-squares fits of single-level cross sections to the multilevel cross sections were performed. If the separation of the resonances is approximately greater than the sum of their widths, it is generally possible to obtain single-level parameters which will yield infinite-dilution capture and fission resonance integrals in reasonable agreement with multilevel values. For closer spacings, two resonances may appear to be one, and the fitting often becomes unsatisfactory. (auth)

**44631** (CONF-660303, pp 1064-72) A NEW APPROACH TO NEUTRON RESONANCE SPECTROSCOPY. Bollinger, L. M. (Argonne National Lab., Ill.).

The use of bremsstrahlung to study highly excited nuclear states of heavy nuclides by means of the ($\gamma$,n) reaction is discussed. In the proposed experiments, neutron time-of-flight spectra give information about states just above the neutron binding energy, the states now studied only by neutron-induced reactions. An effective accelerator for this purpose is an FN Tandem that accelerates electrons from a source in the terminal. Detailed considerations show that ($\gamma$,n) measurements are much more effective than neutron cross-section measurements for obtaining additional information concerning the statistical properties of nuclear energy levels. (auth)

**44632** (CONF-660303, pp 1084-91) PROPOSED RECOIL TECHNIQUE FOR NEUTRON-PROTON DIFFERENTIAL CROSS SECTION MEASUREMENTS IN THE 15-30 Mev RANGE. Benenson, R. E. (City Coll., New York. Columbia Univ., New York); Patton, W. (Columbia Univ., New York).

A method is described for employing a single well-shielded counter for the simultaneous recording of a continuous distribution of recoil angles from a thin radiator. Angles are inferred from the $\cos^2 \theta_0$ angle-energy relation through pulse heights in a high-resolution solid-state detector. Recoil trajectories are caused to converge onto the detector by means of a nearly uniform magnetic field in which the radiator is placed. The possible advantages of such a system are discussed, analytical and graphical methods for specifying the specially shaped pole edges are described, and some practical details of magnet fabrication are mentioned. (auth)

**44633** (EUR-3053.e) INVESTIGATION OF PNC EFFECTS IN THE RADIATIVE CAPTURE OF POLARIZED NEUTRONS: THE CASE OF $^2$H(n,$\gamma$) AND $^{113}$Cd(n,$\gamma$). Forte, M.; Saavedra, O. (European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center). July 1966. 16p. (CONF-650706-26). Dep. mn.

From International Conference on the Study of Nuclear Structure with Neutrons, Antwerp.

Parity non-conservation (PNC) in nuclear electromagnetic interactions may produce interference effects with linear intensity in the F parameter. These effects in the gamma transitions following the capture of polarized neutrons with D and $^{113}$Cd targets were investigated. The target was exposed to a polarized neutron beam obtained from the magnetic mirror installed at the Ispra I reactor. The PNC effect investigated was a possible forward-backward asymmetry of gamma emission with respect to the direction of neutron polarization. In the case of D (n,$\gamma$), the corrected asymmetry parameter, evaluated for the 7.25-Mev capture gamma rays, was $\alpha = (0.45 \pm 2.5)$ $10^{-4}$. From this result an upper limit to the PNC parameter $F \leq 3.10^{-6}$ may be assigned. In the case of $^{113}$Cd (n,$\gamma$), both a range of the gamma spectrum containing mainly the transition to the $0^+$ ground state of $^{114}$Cd and a group of transitions of the first few excited levels of $^{114}$Cd, all having + parities, were considered. In both cases, the corrected $\alpha$ value was within the standard error, which had an order of magnitude of $10^{-4}$. These measurements do not confirm the existence of an asymmetry, which was found by Abov, in a similar experiment where the ground state transition was measured. The order of magnitude of the PNC effect quoted by Abov and the upper limit assigned to it by these measurements are comparable. (S.F.L.)

**44634** (IDO-17188) GAMMA-RAY SPECTROMETRY OF NEUTRON-DEFICIENT ISOTOPES. Annual Progress Report. Heath, R. L.; Cline, J. E. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). June 1966. Contract AT(10-1)-205. 141p. Dep. mn. CFSTI $4.00 cy, $1.00 mn.

Progress in a program of studies of neutron-deficient nuclides using the techniques of gamma spectroscopy is reported. The major objective of this program has been to produce a set of pulse-height spectra representing the response of a standard gamma scintillation spectrometer to radiations emitted in the decay of neutron-deficient nuclides. These spectra are subsequently processed and included in the Scintillation Spectrometry Gamma-Ray Spectrum Catalogue. This effort has been expanded to include a compilation of spectra taken with lithium-ion-drifted germanium detectors. This latter effort also includes the measurement of precise gamma energies for use as secondary standards. A discussion of the techniques employed in the collection of the spectra using Ge(Li) detectors is presented. Work during the year has included the production of over 50 neutron-deficient nuclides by gamma and proton induced reactions using an electron linear accelerator and a cyclotron. Spectra of over 30 individual nuclides are presented in final form. (auth)

**44635** (IN-1012) FISSION CROSS SECTION OF $^{241}$Pu FROM 0.01 ev TO 0.5 ev. Watanabe, T. (Idaho Nuclear Corp., Idaho Falls). July 1966. Contract AT(10-1)-1230. 14p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The fission cross section of $^{241}$Pu was measured from 0.01 to 0.5 ev using the Materials Testing Reactor (MTR) fast chopper with a flight path of 4 meters. The fission events were detected by a gas scintillation fission chamber. Curves of $\sigma_f\sqrt{E}$ as a function of energy are given. Comparisons are made with previously measured fission cross sections. (auth)

**44636** (INP-479/PL) TRANSVERSE SUM RULE FOR ELECTRONS SCATTERED INELASTICALLY WITH LARGE MOMENTUM TRANSFERS FROM LIGHT NUCLEI. Czyz, Wieslaw; Lesniak, Leonard; Malecki, Andrzej (Institute of Nuclear Physics, Krakow (Poland)). May 1966. 45p. Dep.

A sum rule for the cross sections of electrons inelastically scattered from nuclei is analyzed. This sum rule contains contributions only from the transverse electron-nucleus interactions and is particularly suitable for analyzing experiments inelastic electron scattering at $\theta = 180°$. The sum rule is a function of the three momentum transfer q. A discussion of this sum rule for momentum transfers $0.5\ f^{-1} \leq q \leq 2\ f^{-1}$ is presented. Strong dominance of the spin-current contribution seems to offer a very attractive possibility of measuring magnetic moments of nucleons bound in nuclei. Estimates of the short-range nucleon-nucleon correlation contributions to the sum rule are included. (auth)

**44637** (INR-627/IA/PL) BADANIE SCHEMATU ROZPADU $^{23}$Ne I INTERPRETACJA UZYSKANYCH REZULTATOW NA GRUNCIE MODELU KOLEKTYWNEGO Z UWZGLEDNIENIEM SIL CORIOLISA. (Investigation of the Decay Scheme of $^{23}$Ne and Interpretation of the Experimental Results on the Basis of the Collective Model Including Rotation-Particle Coupling). Lancman, H. (Institute of Nuclear Research, Warsaw (Poland)). Sept. 1965. 94p. Dep.

The decay scheme of $^{23}$Ne was investigated with a conventional fast-slow coincidence spectrometer. The isotope $^{23}$Ne was obtained by irradiation of spectrally pure neon with thermal neutrons in a reactor. A loop designed specially for the activation of gases was used for this purpose. Previously unreported $\beta$ transitions to four excited states in $^{23}$Na (2405, 2705, 2870, and 2990 kev) were found, and the corresponding log ft values were established. Two previously unreported excited states in $^{23}$Na (2405 and 2870 kev) were found, and their possible spins and parities were determined. The spin of the 2705 kev state was found to be $^7/_2$. The life-time of the first excited state of $^{23}$Na was measured by means of the resonant scattering method. The relative intensities of the $\gamma$ transitions were determined. The decay scheme of $^{23}$Ne is proposed. (auth)

**44638** (JINR-E-2772) CALCULATION OF NUCLEON-PHONON INTERACTION EFFECTS IN A SIMPLE NUCLEAR MODEL. Bal'butsev, E. B.; Dzholos, R. V.; Mikhailov, I. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1966. 18p. Dep. mn.

The results of calculation of the energy spectra in a simple model with nucleon-phonon interaction are given. Comparison of the exact values of the energy with evidence obtained by strong coupling methods allows one to find the range of application of this method. It is shown that the conditions under which the equidistant character of the spectrum is revealed are considerably wider than those under which the collective degree of freedom is extracted. (auth)

**44639** (JINR-P-2729) NOVYE DANNYE O SPEKTRAKH KONVERSIONNYKH ELEKTRONOV $^{153}$Dy, $^{155}$Dy I $^{157}$Dy. (New Data on the Conversion Electron Spectra of $^{153}$Dy, $^{155}$Dy, and $^{157}$Dy). Gnatovich, V.; Gromov, K. Ya.; Mukhtasimov, F. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1966. 22p. Dep. mn.

The spectra of the conversion electrons of $^{153}$Dy, $^{155}$Dy, and $^{157}$Dy were measured using a permanent magnet spectrograph, and the data were tabulated. The decay modes of these isotopes were also considered. (S.F.L.)

**44640** (JINR-P-2793) ZAMKNUTYE OBOLOCHKI S $Z > 82$ I $N > 126$ V RASCHETAKH S DIFFUZIONNYM POTENTSIALOM. (Closed Shells for $Z > 82$ and $N > 126$ in a Diffuse Potential Well). Gareev, F. A.; Kalinkin, B. N.; Sobichevski, A (Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Theoretical Physics). 1966. 8p. Dep. mn.

Proton and neutron single-particle levels in a Woods-Saxon potential well with a spin-orbit term are calculated for $Z > 82$ and $N > 126$ as functions of the mass number A. The possible magic numbers are found to be $Z = 114$ and $N = 184$. (auth)

**44641** (JINR-P-2796) DIFFERENTSIAL'NYE SECHENIYA REAKTSII $^{16}O(t,\alpha)^{15}N$ I $^{16}O(t,p)^{18}O$ V INTERVALE ENERGII 0.6−1.75 Mev. (Differential Cross Section of $^{16}O(t,\alpha)^{15}N$ and $^{16}O(t,p)^{18}O$ Reactions at Energy Range From 0.6 to 1.75 Mev). Kobzev, A. P.; Gromov, A. V.; Kashlik, K.; Nedvedyuk, K.; Salatskii, V. I.; Telezhnikov, S. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1966. 9p. Dep. mn.

Measurements were made on the reactions $^{16}O(t,\alpha_0)^{15}N$, $^{16}O(t,\alpha_{1+2})^{15}N^*$, $^{16}O(t,p)^{18}O$, and $^{16}O(t,p_1)^{18}O^*$ at 90° and at triton energies from 0.6 to 1.75 Mev. The energy levels of $^{19}$F were studied. (R.V.J.)

**44642** (JINR-P-2808) O RADIATSIONNOI EDINITSE I KRITICHESKOI ENERGII V Xe. (Radiative Unit and Critical Energy in Xe). Nichiporuk, B.; Slovinskii, B.; Strugal'skii, Z. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1966. 5p. Dep. mn.

Correlation of theoretical results with experimental data obtained during irradiation of a 55-cm xenon bubble chamber with 9 Bev/c mesons ($\pi^-$) showed that the cross sections obtained for the absorption of $\gamma$ quanta in Xe ($\sigma_\gamma = 19.0 \pm 0.8$) is in good agreement with the theoretical results. (R.V.J.)

**44643** (JINR-P-2819). IZUCHENIE SKHEMY RASPADA $^{138*}$Pr. (Investigation of the Decay Scheme of $^{138*}$Pr). Babadzhanov, R.; Vrzal, Ya.; Gromov, K. Ya.; Liptak, Ya.; Morozov, V. A.; Mukhtasimov, F. N.; Urbanets, Ya. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1966. 24p. Dep. mn.

Two previously unreported energy levels at 2371.8 and 2482.6 kev with spins of 5 or 6 and $6^+$ or $7^+$, respectively, were observed in a study of the decay of isomeric $^{138}$Pr. Two previously unreported $\beta^+$ components with energies of 1.41 and 1.56 Mev were found. An assignment of $6^-$ was made for the isomeric state of $^{138}$Pr. (D.C.W.)

**44644** (LNF-66/32) PHOTODISINTEGRATION OF LITHIUM SIX AT HIGH ENERGY. Note No. 326. Allton, E.; Ferroni, S.; Graco, V. G.; Merkel, B.; Schaerf, C. (Laboratori Nazionali di Frascati, Comitato Nazionale per l'Energia Nucleare (Italy)). June 24, 1966. 7p. Dep. mn.

The photodisintegration of $^6$Li was studied at high energies by the reaction $e + {}^6Li \rightarrow e' + d + \alpha^*$. Measurements were performed at a constant angle and momentum for the outgoing deuteron, varying the primary electron energy. The differential cross section is given as a function of excitation energy. (S.F.L.)

**44645** (NAA-SR-11706) 2-PLUS, A NONSPHERICAL OPTICAL MODEL FOR FAST NEUTRON CROSS SECTIONS. Dunford, C. L. (Atomics International, Canoga Park, Calif.). July 15, 1966. Contract AT(11-1)-Gen-8. 93p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

The 2-PLUS computer code is written in FORTRAN II for the IBM-7094 to solve the problem of the scattering of nucleons by a deformed nuclear potential. It is assumed that the ground state ($0^+$) and the first excited level ($2^+$) are strongly coupled by the deformed potential. All other levels are treated in the weak coupling limit (spherical potential). A compound nucleus theory is included so that lower energy neutron scattering may be calculated. Elastic and inelastic cross sections, as well as angular distributions, may be calculated. These calculated cross sections may be plotted and compared with experimental data by the code. (auth)

**44646** (NAA-SR-11973) OPTICAL-MODEL ANALYSIS OF SOME RECENT TUNGSTEN CROSS-SECTION MEASUREMENTS. Dunford, Charles L. (Atomics International, Canoga Park, Calif.). July 15, 1966. Contract AT-11-1-GEN-8. 97p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Recent measurements of neutron scattering properties of the isotopes $^{182}$W, $^{184}$W, and $^{186}$W in the energy region between 0.3 and 1.5 Mev were analyzed using a combined nonspherical optical model and improved compound nucleus theory. Significant improvements over previous calculations for tungsten in this energy region are noted and are discussed. Recommended microscopic cross-section information for the even-even tungsten isotopes over the energy range 0.3 to 1.5 Mev are presented. Some discussion of higher energy-interactions in the light of the present analysis is also presented. (auth)

**44647** (NIJS-R-484) THE ANALYSIS OF THE LOW LYING $0^{+\prime}$ STATES IN THE MIDDLE WEIGHT NUCLEI. Kregar, M.; Mihailovic, M. V. (Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia)). May 1966. 20p. Dep. mn.

The low-lying spectra of some middle-weight nuclei are analyzed in terms of the vibrational model and the Davydov nonadiabatic model. It is shown that it is not possible to interpret the $0^{+\prime}$ states in $^{70}$Ge, $^{72}$Ge, $^{74}$Ge, and $^{76}$Se and maybe in some other nuclei as a two-phonon vibrational state. On the other hand some critical data like $B(E2; 0^{+\prime} \rightarrow 2^+)/B(E2; 0^+ \rightarrow 2^+)$ and the effective $\gamma$-deformation of such nuclei can be interpreted by means of the Davydov nonadiabatic model where the $0^{+\prime}$ states belong to the oblate-shape ellipsoid. (auth)

**44648** (NRDC-117) A MEASUREMENT OF THE VARIATION OF THE RATIO OF FISSION TO ABSORPTION IN $^{235}$U BETWEEN 1 AND 100 ev INCIDENT NEUTRON ENERGY. Collins, E. R.; Kavanagh, T. M.; Lynn, J. E. (Atomic Energy Research Establishment, Harwell (England)). Aug. 1959. 25p. Dep. mn.

The energy variation of $n/\bar{\nu}$ (n = number of prompt fission neutrons emitted per neutron absorbed and $\bar{\nu}$ = average number of prompt neutrons per fission) for neutron energies between 1 and 100 ev was measured for $^{235}$U using a method which takes into account the neutrons scattered out of the sample. The variation of the fission yield was measured by recording coincident pulses from a pair of scintillating detectors placed on either side of the sample as a function of neutron time-of-flight in a 99-channel analyzer. (S.F.L.)

**44649** (ORNL-3887) DIFFERENTIAL CROSS SECTIONS FOR THE PRODUCTION OF PROTONS IN THE REACTIONS OF 160-Mev PROTONS ON COMPLEX NUCLEI. Peelle, R. W.; Love, T. A.; Hill, N. W.; Santoro, R. T. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 101p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Differential cross sections in angle and energy were obtained by flight-time spectrometry for secondary protons above 20 Mev from 160-Mev protons on Be, C, $H_2O$, Al, Co, and Bi targets. Enough angles were studied for rough angular distributions to be presented for Al and Co. All secondary charged particles were assumed to be protons, for which the energy resolution varied from 25 to 50%. The observed differential cross sections change smoothly with angle and target mass, and show no peak corresponding to quasi-free scattering near the energy corresponding to free nucleon-nucleon scattering. The measurements are compared with others available at the same energy and with intranuclear cascade estimates, including evaporation. The observed cross sections are larger than the estimated ones at angles of 90 and 120°, and at low energies for angles more forward than 45°. At 60° the observed cross sections are in accord with the Monte Carlo estimates. (auth)

**44650** (ORNL-P-2412) A SEARCH FOR THE TRINEUTRON. Thornton, S. T.; Jones, C. M.; Bair, J. K.; Willard, H. B. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 8p. (CONF-660906-21). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

Experimental and theoretical evidence was recently proposed for the existence of the trineutron, a stable particle composed of three neutrons bound by 1.0 Mev. A search for the trineutron in the reaction $T(n,p)n^3$ with 20.8-Mev neutrons was made, and no evidence for the existence of the trineutron was found. (auth)

**44651** (ORNL-P-2434) DIFFERENTIAL SCATTERING OF NEUTRONS FROM OXYGEN AND INTERMEDIATE STATES. Fowler, J. L.; Johnson, C. H. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 9p. (CONF-660906-19). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

The explanation of the broad structure in the total neutron cross section of $^{16}$O between 3 and 4 Mev is of importance to the understanding of intermediate states. At 3.77 under a 17-kev $f_{7/2}$ resonance a 3-kev $d_{3/2}$ resonance interfering with a large $d_{5/2}$ phase shift is found; thus a difficulty in resonance parameter assignments at the peak is removed. (auth)

**44652** (ORNL-P-2468) DEPENDENCE OF BRUECKNER-HARTREE-FOCK CALCULATIONS FOR LIGHT NUCLEI ON DETAILS OF THE NUCLEON-NUCLEON INTERACTION: COMPARISON OF THE YALE, HJ, AND REID POTENTIALS. Becker, Richard L.; MacKellar, A. D.; Morris, B. M. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 9p. (CONF-660906-25). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

Calculations of matrix elements of Brueckner's reaction matrix and the Bethe-Goldstone wave functions for pairs of nucleons in light nuclei were carried out for the three currently most prominent phenomenological nucleon-nucleon interactions. Significant differences in binding energies, single-particle energies, spin-orbit splittings, and effective interactions are found. The proton-proton correlation function was derived and evaluated. (auth)

**44653** (PUC-937-219) COUPLED CHANNELS AND THEIR APPLICATION TO RESONANCES IN THE SCATTERING OF LOW-ENERGY NEUTRONS BY $^{12}C$. Roeder, John Louis (Princeton Univ., N. J. Palmer Physical Lab.). Sept. 1966. Contract AT(30-1)-937. 196p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Thesis.

The importance of channel coupling in nuclear reactions is discussed, and the coupled Schrödinger equations solved in many-channel calculations for nuclear reactions are formulated. The solutions are discussed in detail, particularly from the viewpoint of the reaction and transition matrices. Coupled-channel computer calculations are presented for low-energy neutron scattering by $^{12}C$ and for other examples of more general interest, in which resonances are investigated from the viewpoints of scattering cross sections, phase shifts, and poles of the transition matrix. Many of these resonances are seen to arise from channel coupling. Wherever possible, the results of calculations are compared with analytic results which have been obtained only for special cases. The behavior of resonances near channel thresholds is also discussed. (D.C.W.)

**44654** (PUC-937-227) APPLICATION OF MULTI-PARTICLE COLLISION THEORY TO THE STUDY OF DIRECT NUCLEAR REACTIONS. Noble, Julian V. (Princeton Univ., N. J. Palmer Physical Lab.). Aug. 1966. Contract AT(30-1)-937. 115p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Thesis.

The solution of problems in nuclear physics from the viewpoint of multi-particle collision theory is considered. Nonrelativistic collision theory is briefly reviewed, with particular emphasis on recent developments in multiparticle potential scattering theory. A set of linear integral equations describing deuteron scattering is derived using methods similar to those of Faddeev. These equations (of the Fredholm type) are contrasted with the usual distorted-wave Born approximation treatment of deuteron reactions. Various simplified versions of these equations are then described, and the numerical solution of a simple test case is discussed. An existence proof of spurious homogeneous solutions of Weinberg's three-body equations (in a special case), a new set of three-particle scattering equations particularly suited to deuteron collisions, and a new method of proof of the existence of the analytic continuations of three-particle amplitudes (defined for complex energy) to real, positive energies are included. (auth)

**44655** (SZS-4/66) TABELLE WICHTIGER $\beta$-MAXIMALENERGIEN. (Tables of Maximum Energies of Characteristic $\beta$-Decay). Loessner, V. (Staatliche Zentrale fuer Strahlenschutz, Berlin (East Germany)). Apr. 1966. 40p. Dep. mn.

The maximum energies characteristic of $\beta$ decays are given for 120 isotopes arranged by order of energy. The table can be used in identifying unknown beta-emitting isotopes if the maximum energy is measured. (S.F.L.)

**44656** (TID-23315) A COMPUTER PROGRAM FOR AUTOMATIC DECOMPOSITION OF SPECTRA FROM CHARGED-PARTICLE REACTIONS. Spink, Paulette; Erskine, John R. (Argonne National Lab., Ill.). Dec. 1965. Contract W-31-109-eng-38. 33p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

A computer program to decompose spectra from charge-particle reactions was written in FORTRAN 3600 for CDC-3600 computer. This program greatly increases the precision of the determination of the relative intensities and positions of the particle groups in the spectrum. Initial guesses of the positions are made automatically and a $\chi^2$ function is formed for each complex spectrum and minimized with respect to the positions of the groups by means of a variable-metric minimization program. (auth)

**44657** (UCRL-16602) REACTION CHANNELS IN THE CAPTURE OF $K^-$-MESONS BY COMPLEX NUCLEI. Patrick, Jack W. (Lawrence Radiation Lab., Univ. of California, Berkeley). Mar. 1, 1966. Contract W-7405-eng-48. 116p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Thesis.

A total of 13,600 $K^-$-mesons at rest were observed in two nuclear emulsion stacks. The emission of hyperons, pions, and hyperfragments from 3900 of the $K^-$-capture stars was studied extensively. The identification of the hyperons is discussed. Charged $\Sigma$-hyperons are emitted from (17.3 ± 1.2) percent of all $K^-$ stars in the completely analyzed stack from which the figures following are quoted. The $\Sigma^+/\Sigma^-$ ratio for all stars is 1.08 ± 0.08, while the proportion of stars from which pions are emitted is 0.38 ± 0.05. About 11 percent of all identified charged $\Sigma$-hyperons had an energy above 60 Mev, and were therefore attributed to multinucleon reaction channels. The proportion of all multinucleon primary reaction processes may be as high as 46 percent. A detailed examination of the pion-emitting events and of the sign ratio of the mesons has led to an estimate of the probabilities of absorption of $\Sigma$-hyperons in the parent nucleus, and to a partition of events between the various single-nucleon reaction channels. On the basis of the Coulomb barrier and Auger electron emission, discrimination is made between $K^-$ capture on light (C,N,O) nuclei and on heavy nuclei (Ag, Br). For the single-nucleon reaction channels it is found that $K^-$ capture by a light nucleus is 1.16 times as likely to produce a pion as a $K^-$ capture by a heavy nucleus. For the multinucleon channels, it is determined that $K^-$ interaction with a light nucleus is 2.36 times as likely to produce a fast ($T_\Sigma > 60$ Mev) $\Sigma$-hyperon as interaction with a heavy nucleus. The mechanism of light ($Z < 7$) hyperfragment formation, excluding cryptofragments, is shown by analysis of the pion spectra accompanying the hypernuclear prong to be primarily one of $\Sigma$ conversion (80 percent). A study of the relative number of captures on light and on heavy nuclei yielded the result that less than 20 percent of the production of these light hyperfragments took place on heavy nuclei. Further, a limit of 30 percent was placed on the fraction of light hyperfragments produced in multinucleon reactions. Evidence for the $Y_0^*$ (1405) is studied with $\Sigma\pi$ mass spectra from $K^-$ interactions on $^{12}C$. The results can be explained on an impulse model without recourse to resonance formation. Production of $Y_0^*$ with a width of <20 Mev is not confirmed. (auth)

**44658** (UCRL-16984) TEST OF A MICROSCOPIC DESCRIPTION OF NICKEL ISOTOPES BY INELASTIC PROTON SCATTERING. Glendenning, Norman K.; Harvey, B. G.; Hendrie, D. L.; Jarvis, O. N.; Mahoney, Jeannette (Lawrence Radiation Lab., Univ. of California, Berkeley). July 1966. Contract W-7405-eng-48. 10p. (CONF-660906-17). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

The inelastic scattering of protons from $^{58}Ni$ and $^{60}Ni$ is compared with the results of a coupled-channel scattering calculation using a microscopic nuclear description. Comparison with DWBA results shows the necessity for a full coupled-channel treatment. It is shown that this kind of analysis provides a sensitive test of nuclear wave functions. Suggestions for improving the wave functions of these nuclei are made. (auth)

**44659** (UCRL-16990) $^{37}$Ca AND THE MASS 37 T = 3/2 QUARTET. Cerny, J.; Cosper, S. W.; Butler, G. W.; McGrath, R. L. (Lawrence Radiation Lab., Univ. of California, Berkeley). July 1966. Contract W-7405-eng-48. 9p. (CONF-660906-32). Dep. mn CFSTI $1.00 cy, $0.50 mn.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

The mass 37 isospin quartet was completely determined, thus furnishing another test of the isobaric multiplet mass equation. A three-counter-telescope, particle-identification system determined the $^{37}$Ca mass excess via the $^{40}$Ca($^3$He,$^6$He)$^{37}$Ca reaction. The lowest $T = {^3}\!/_2$ states of $^{37}$Ar and $^{37}$K were located through the $^{39}$K(p,$^3$He)$^{37}$Ar* and $^{39}$K(p,t)$^{37}$K* reactions. (auth)

**44660** (UCRL-70002) PHOTONEUTRON MEASUREMENTS OBTAINED WITH MONOCHROMATIC PHOTONS. Fultz, S. C. (Lawrence Radiation Lab., Univ. of California, Livermore). [1966]. Contract W-7405-eng-48. 12p. (CONF-660906-16). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

Some results obtained on photoneutron cross section measurements made with the use of the Livermore monochromator are discussed. It is shown that the data agree well with the predictions of the classical photonuclear theory. Data is presented on the cross sections for neutrons and protons emitted from $^{16}$O in transitions to excited states, and on ($\gamma$,n) and ($\gamma$,2n) cross sections for zirconium isotopes. (auth)

**44661** (UNC-5139) NEUTRON CROSS SECTIONS OF NITROGEN, OXYGEN, ALUMINUM, SILICON, IRON, DEUTERIUM, AND BERYLLIUM. Ray, J. H.; Grochowski, G.; Troubetzkoy, E. S. (United Nuclear Corp., Elmsford, N. Y.). Nov. 15, 1965. Contract DA-18-035-AMC-125(A). 211p. CFSTI $6.00 cy, $1.25 mn.

Neutron cross-section sets were prepared for N, O, Al, Si, Fe, D, and Be for neutron energies from 0.037 ev to 18 Mev. The cross sections tabulated include the total, elastic, inelastic, and (n,2n) cross sections, as well as cross sections for charged-particle emission. Information is also given on the angular distribution of elastically scattered neutrons and on the energy distribution of neutrons and $\gamma$ rays following nonelastic reactions. (auth)

**44662** (USC-136-111) THE EFFECT OF THE Z = 28 SHELL CLOSURE ON PROTON TOTAL REACTION CROSS SECTIONS. Waddell, C. N.; Cole, R. K.; Makino, M. Q.; Montague, D. G. (University of Southern California, Los Angeles). July 1966. Contract AT(04-3)-136. 14p. (CONF-660906-15). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

Proton total reaction cross sections at 17 Mev for nuclei near the Z = 28 shell closure have been measured. The magnitude of the dip at Ni previously observed is found to be energy independent. The variation in cross sections is greater than those predicted by published optical-model analyses of the elastic differential cross sections. (auth)

**44663** (WAPD-TM-571) SCAT-1: A PROGRAM TO COMPUTE $T^n_{LL'}$ MATRICES ON THE PHILCO-2000. Gelbard, E. M.; Peters, G. J. (Bettis Atomic Power Lab., Pittsburgh, Pa.). June 1966. Contract AT-11-1-GEN-14. 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The computer program SCAT-1 is used to compute $T^n_{LL}$ matrices on the Philco-2000. The program computes $T^2_{LL^1}$ for $0 \leq L^1 \leq 10$, $0 \leq L \leq 3$, $0 \leq n \leq 3$. These T's are computed in double precision through the use of a set of recursion relations. (B.G.D.)

**44664** (BNL-tr-65) TABLES GIVING THE INTERNAL CONVERSION COEFFICIENTS OF $\gamma$-RADIATION ON THE K- AND L- SHELLS. Sliv, L. A.; Band, I. M. Translated by Stephen J. Amoretty (Brookhaven National Lab., Upton, N. Y.), from a Russian Publication. 11p. Dep. mn. JCL $1.60 fs, $0.80 mf.

The equations and methods used in obtaining the values for the tables are given. The electrostatic potential outside the nucleus was selected taking into account the shielding obtained using the Thomas-Fermi-Dirac method. The eigenvalues of energy-e-eigenvalue and the $\tilde{G}$ and $\tilde{F}$ eigenfunctions of the bound electrons were obtained simultaneously. All the calculations were carried out twice on the BESM-1 computer of the Academy of Sciences of the USSR with a numerical integration of the differential equation system: after the first time, the numerical integration relative error of the equation did not exceed $10^{-5}$, after the second time it was $0.5 \times 10^{-7}$. In this case, the difference in the eigenvalues was less than $10^{-6}$. The eigenvalues were determined with the D exchange correction taken into account and without it. (M.H.R.)

**44665** (INDSWG-101) BULLETIN OF THE INFORMATION CENTRE ON NUCLEAR DATA. Translated from Byull. Inform. Tsentra Yadern. Dannym, No. 2, 5-232 (1965). 234p. Dep. mn. JCL $15.50 fs, $7.22 mf.

Separate abstracts were prepared for 6 of the 7 papers included. The remaining paper, which is on the proton fission cross sections of $^{209}$Bi, $^{197}$Au, Pb, Pt, Re, $^{181}$Ta, $^{232}$Th, $^{235}$U, and $^{238}$U, was previously abstracted for NSA 20: 8144. (D.C.W.)

*For abstracts of individual papers see: 44666—44671.*

**44666** (INDSWG-101, pp 1-22) REACTIONS ACCOMPANIED BY THE EMISSION OF CHARGED PARTICLES CAUSED BY SLOW NEUTRONS. Andreev, V. N.; Popov, Yu. P. Translated from Byull. Inform. Tsentra Yadern. Dannym, No. 2, 5-24(1965).

A review of some data on the reactions (n,$\alpha$), (n,p), and (n,t) is presented, dealing primarily with slow-neutron reactions on light nuclei. The information obtained from the various studies of these reactions is also considered. (D.C.W.)

**44667** (INDSWG-101, pp 23-72a) PARAMETERS OF DISCRETE RESONANCE LEVELS. Zakharova, S. M.; Abagyan, L. P. Translated from Byull. Inform. Tsentra Yadern. Dannym, No. 2, 25-75(1965).

Tables of the parameters of discrete resonance levels are presented for nuclei with Z = 18 to 95. $^{243}$Am, $^{237}$Np, $^{233}$U, $^{234}$U, and $^{236}$U are not included. (D.C.W.)

**44668** (INDSWG-101, pp 73-108) INELASTIC SCATTERING OF NEUTRONS. Sluchevskaya, V. M. Translated from Byull. Inform. Tsentra Yadern. Dannym, No. 2, 76-111(1965).

Tables of data for neutron inelastic scattering by some nuclei with Z = 3 to 92 are presented. Cross sections for gamma emission and energy-level excitation are included, together with nuclear temperatures and neutron and gamma angular distributions. (D.C.W.)

**44669** (INDSWG-101, pp 109-57) ELASTIC SCATTERING OF NEUTRONS. Bazazyants, N. O.; Popov, V. I. Translated from Byull. Inform. Tsentra Yadern. Dannym, No. 2, 112-60(1965).

The results of some experimental work on neutron elastic scattering by elements with Z = 13 to 92 are presented. The angular distributions of scattered neutrons are given in the form of series expansion coefficients with the Legendre polynomial. Formulas are included with which the differential cross sections can be calculated for any scattering angle. (D.C.W.)

**44670** (INDSWG-101, pp 158-63) DELAYED NEUTRONS AND THE (n,nf) REACTION IN URANIUM ISOTOPES. Maksyutenko, B. P. Translated from Byull. Inform. Tsentra Yadern. Dannym, No. 2, 161-6(1965).

The results of an investigation of the variation in the yield of delayed neutrons with the energy of the neutrons inducing fission are presented. The fission of $^{233}$U by neutrons with maximum energies of 2.3, 5.6, and 7.25 Mev and the fission of $^{235}$U by neutrons with a maximum energy of 7.22 Mev were studied. (D.C.W.)

**44671** (INDSWG-101, pp 164-223) CROSS-SECTIONS OF NEUTRON REACTIONS ACCOMPANIED BY EMISSION OF CHARGED PARTICLES. Abagyan, L. P.; Zakharova, S. M. Translated from Byull. Inform. Tsentra Yadern. Dannym, No. 2, 167-226(1965).

A compilation of experimental data on the cross sections of neutron reactions with charged-particle emission is presented for elements with Z = 13 to 28. 138 references. (D.C.W.)

**44672** (LA-tr-66-34) DELAYED NEUTRONS AT THE FISSION THRESHOLD OF $^{232}$Th. Maksyutenko, B. P. Translated by A. D. Cernicek (Los Alamos Scientific Lab., Univ. of California, N. Mex.), from report FEI-26. 4p. Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.10 fs, $0.80 mf.

The relative yields of delayed neutron groups from the neutron fission of $^{232}$Th were measured as a function of incident neutron energy using T(p,n)$^{3}$He neutrons with maximum energies of 1.6, 1.9, 2.2, and 2.6 Mev. (D.C.W.)

**44673** (LA-tr-66-36) THE MULTIPARAMETER INVESTIGATIONS OF THE FISSION FRAGMENTS FOR THE FISSION OF $^{235}$U INDUCED BY THERMAL NEUTRONS AND 5 Mev, 6 Mev, AND 7 Mev NEUTRONS. Vorob'eva, V. G.; Dyachenko, P. P.; Kuz'minov, B. D.; Tarasko, M. Z. Translated by A. D. Cernicek (Los Alamos Scientific Lab., Univ. of California, N. Mex.), from report FEI-24. 14p. Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.60 fs, $0.80 mf.

The dependence of the total kinetic energy of fission fragments on their mass ratio in the neutron fission of $^{235}$U was investigated using thermal neutrons and neutrons with energies of 5, 6, and 7 Mev. (S.F.L.)

**44674** DEPENDENCE OF THE EQUILIBRIUM DENSITY OF NUCLEAR MATTER ON THE NEUTRON EXCESS. Dworzecka, Maria (Univ. of Warsaw). Acta Phys. Pol., 29: 783-95(June 1966).

The equilibrium density (or equivalently Fermi momentum $k_F$) of nuclear matter for $\alpha \neq 0$ ($\alpha = (N - Z)/A$) is investigated. In calculating $\Delta k_F = k_F(\alpha) - k_F(0)$ only terms quadratic in $\alpha$ are considered. The result obtained is $\Delta k_F/k_F = -1/2\ \alpha^2 k_F (d\epsilon_{sym}/dk_F)\ K$ ($\epsilon_{sym}$ = symmetry energy, K = nuclear compressibility). A general expression of $d\epsilon_{sym}/dk_F$ is derived in the frame of the Brueckner theory. The numerical result, based on the Brueckner-Gammel solution for nuclear matter, is $\Delta k_F = -0.49\ \alpha^2 F^{-1}$. (auth)

**44675** AN EXACT ANALYTICAL FORMULA FOR THE PHASE SHIFT OF ELASTIC SCATTERING OF HIGH-ENERGY ELECTRONS BY NUCLEI OF FINITE SIZE. Nowak, W. (Univ. of Lodz, Poland). Acta Phys. Pol., 29: 837-40(June 1966).

An exact analytical formula for the phase shift of elastic scattering of high energy electrons by nuclei is derived. The phase shifts are repressed by the known functions. The only requirement for the potential is the coulomb behavior at infinity. (auth)

**44676** QUASI-SPIN REPRESENTATIONS OF THE ORTHOGONAL GROUP $R_5$. Szpikowski, Stanislaw (Curie-Sklodowska Univ., Lublin). Acta Phys. Pol., 29: 853-74 (June 1966).

Using the quasi-spin method first applied to nuclear physics by Kerman some problems concerning the $R_5$ group and its quasi-spin realization are discussed. The Clebsch-Gordan series for some Kronecker products of two I.R.s (irreducible representations) and a prescription for the general case are obtained. The decomposition of an I.R. of $R_5$ into I.R.'s of the "mathematical" subgroup $R_3 \times R_3$ the general case, and of the "physical" subgroup $R_2 \times R_3$ in some special useful cases are obtained, and a complete basis of states for the "mathematical" representation is set up in terms of which the matrix elements of the group generators are calculated. The same is done for the "physical" representations in special cases. (auth)

**44677** ENERGY SPECTRUM AND ANGULAR DISTRIBUTION OF NEUTRONS FROM THE $^{7}$Li(d,n)$^{8}$Be REACTION AT 200 kev DEUTERON ENERGY. Maluszynska, K. (Univ. of Lodz, Poland). Acta Phys. Pol., 29: 907-9(June 1966).

The results for the energy and angular distribution of neutrons from the $^{7}$Li(d,n)$^{8}$Be reaction were measured for deuteron energies of 200 kev. From the asymmetry of the angular distribution it is inferred that the contribution of direct interactions is considerable. (J.F.P.)

**44678** METHOD FOR SOLVING THE NUCLEON-PHONON INTERACTION PROBLEM. Mikhailov, I. N.; Jolos, R. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Acta Phys. Pol., 30: 237-50(Aug. 1966).

A method to solve the Schroedinger equation for fermions interacting with phonons for the case of a sufficiently small number of different fermion states is suggested. The method is described by an example of a problem with one type of a scalar phonon coupling the orbitals of two energy levels in a spherical nucleus. The method consists of an introduction of the generating functions of a complex variable z. The Taylor coefficients of the functions are simply related to the probability amplitudes of the n-phonon excitation in an eigenstate of the system. The solution of the Schroedinger equation is achieved by finding the integrals of a system of first-order differential equations which are given by entire functions. Such solutions are found in the limits of a weak and strong coupling and in the special case of a resonance between the phonon and nucleon excitation energies. (auth)

**44679** ELECTRON SCATTERING AND NUCLEAR STRUCTURE. deForest, T. Jr.; Walecka, J. D. (Stanford Univ., Calif.). Contract AF 49(638)-1389. Advances Phys., 15: No. 57, 1-109(Jan. 1966).

A review of information about nuclear structure contained in the various regions of the spectrum is given. The discussion is given in the framework of the first Born approximation. Topics considered include electron scattering cross section, scattering to discrete nuclear levels, some nuclear models of discrete transitions, quasi-elastic scattering, sum rules, meson production, and higher-order and radiative corrections. (J.F.P.)

**44680** CLASSIFICATION AND ANALYSIS OF NMR SPECTRA. Dischler, B. (Fraunhofer-Gesellschaft, Freiburg i. B.). Angew. Chem. Int. Ed. Engl., 5: 623-33(July 1966).

Classification and interpretation of the nuclear magnetic resonance spectra, obtained at high resolutions, is presented. Topics discussed are the types of NMR spectra, basic principles for the mathematical treatment of NMR spectra, samples of simple spin systems, methods for the analysis of NMR spectra, comparison of various analytical methods using the $A_2B_2$ spectrum of o-dichlorobenzene, and suggestions for analysis of NMR. (D.H.M.).

**44681** ($\gamma$,n) ACTIVATION BY A LINAC. Azuma, Toshio; Sato, Yuji. Ann. Rep. Radiat. Center Osaka Prefect., 6: 42-5(1965).

The ($\gamma$,n) activation products were measured for 22 elements as compounds after exposure to bremsstrahlung from the electron beam of an accelerator, and the shell assignments of protons and neutrons in these elements were considered. The effective photon flux for the ($\gamma$,n) reaction was estimated to be $8.5 \pm 0.5 \times 10^9$ photons/cm$^2$ sec for the electron linac of 16 Mev at 30$\mu$amp. The total activities of these elements observed is $0.1 \sim 2\ \mu$c. (auth)

**44682** NUCLEAR LEVEL OF $^{44}$Ca. Azuma, Toshio; Sato, Yuji. Ann. Rep. Radiat. Center Osaka Prefect., 6: 46-50(1965).

The energy levels of $^{44}$Ca were investigated using the reaction $^{45}$Sc($\gamma$,n)$^{44m}$Sc as the source of $^{44m}$Sc. Gamma spectra were obtained at several gate energies using a sum-coincidence system, and $\gamma$-$\gamma$ (0.72-1.16 Mev) directional angular correlations were measured. It was determined that the 1.88-Mev level of $^{44}$Ca has an assignment of $1^+$ or $3^+$. (D.C.W.)

**44683** $^{19}$F(γ,n) CROSS SECTION FROM THRESHOLD TO 14 Mev. Okabe, Shigeru; Fukuda, Kyue; Tabata, Tatsuo; Tsumori, Kunihiko; Sato, Yuji; Azuma, Toshio. Ann. Rep. Radiat. Center Osaka Prefect., 6: 64-7(1965).

The $^{19}$F(γ,n) reaction was studied using bremsstrahlung from a teflon target irradiated with a beam of electrons at 10 to 14 Mev. The maximum cross section of the reaction in the range below the giant resonance was found at an incident γ energy of 12.5 Mev. The integrated cross section under the 12.5 Mev peak was measured to be 1.0 Mev-mb and was compared with the theoretical value. The angular distribution of neutrons emitted at the 12.5-Mev peak was also investigated. (S.F.L.)

**44684** $f_{5/2-}$ PAIRING APPROXIMATION FOR $p_{3/2+}$ AND $f_{5/2-}$ NUCLEAR SHELLS. Szpikowski, Stanislaw (Universitatis Mariae Curie-Sklodowska, Lublin). Ann. Univ. Mariae Curie-Sklodowska, Lublin-Pol., Sect. AA, 19: 77-87(1964).

The energy level structure of odd and even nuclei was studied using the pairing approximation for $p_{3/2+}$ and $f_{5/2-}$ shells. A quasi-spin formalism was used to diagonalize the pairing Hamiltonian. The theoretical predictions were compared with experimental data for odd nuclei with seniority = 1 and with identical nucleons on the $p_{3/2+}$ and $f_{5/2-}$ shells. (D.C.W.)

**44685** PENETRATION OF $^{235}$U FISSION FRAGMENTS THROUGH $H_2$, $D_2$, He, $N_2$, Ar, Kr, AND Xe. Nasyrov, F.; Linev, S. V. At. Energ. (USSR), 20: 464-8(June 1966). (In Russian).

The mean path of the most probable fission fragments of the heavy and light groups was experimentally investigated. The distribution of the specific energy losses on the ionization tracks was measured in dependence on the initial energy of the fission fragments. The results of the measurement were compared with the calculated values of the path and energy loss of fragments per unit length of track. (tr-auth)

**44686** PARTICLES OF ABNORMALLY LONG RANGE EMITTED BY $^{210}$Po. Morand, M.; Winand, L.; Baudinet-Robinet, Y. (Univ., Liege). Bull. Soc. Roy. Sci. Liege, 35: 216-21(1966). (In French).

The emission of particles with exceptionally long ranges by $^{210}$Po sources was investigated. Some of the emission was interpreted as protons. The ratio of the number of long-range particles to the number of normal alpha particles is roughly independent of the origin, nature, and age of the Po source. The origin of the particles can not be explained in terms of any known (α,p) reaction. (D.C.W.)

**44687** FARADAY-CUP MEASUREMENT OF PROTON TOTAL REACTION CROSS SECTIONS AT 100 Mev. Kirkby, P.; Link, W. T. (McGill Univ., Montreal). Can. J. Phys., 44: 1847-62(Aug. 1966).

The proton total reaction cross sections of 41 elements were measured at 99 Mev, using a double Faraday cup to measure the proton-beam attenuation. The results are consistent with the semiclassical form of the absorption cross section with a nuclear radius parameter of 1.47 fm (1 fm = $10^{-13}$ cm) and a mean free path for 99-Mev protons in nuclear matter of 5.7 fm. (auth)

**44688** INTERMEDIATE-STATE REORIENTATION OF ORIENTED NUCLEI. Daniels, J. M.; Misra, Sushil K. (Univ. of Toronto). Can. J. Phys., 44: 1965-84(Sept. 1966).

When radioactive nuclei in a paramagnetic ion at low temperatures become oriented (the magnetic hfs method of nuclear orientation) and decay by β emission followed by a delayed γ ray, these nuclei frequently become reoriented between the emission of the β ray and the γ ray, and this reorientation affects the observed angular distribution of the γ ray. The theory of this reorientation process is presented, assuming a time-independent hamiltonian during the reorientation period. Numerical calculations of the effects to be expected on this static reorientation model were made for $^{175}$Yb, $^{147}$Nd, and $^{141}$Ce in cerium magnesium nitrate, $^{57}$Co in cerium zinc nitrate, and $^{147}$Nd in neodymium ethyl sulfate. These calculations are compared with the reported experimental results. The experimental values for $^{147}$Nd in neodymium ethyl sulfate, $^{141}$Ce in cerium magnesium nitrate, and $^{57}$Co in cerium zinc nitrate could be explained by the static reorientation model; the others could not. The need is stressed for more reliable experimental results, in order to develop the theory of reorientation further. (auth)

**44689** CROSS SECTIONS AND RESONANCE INTEGRALS FOR THE NEUTRON ACTIVATION OF $^{103}$Rh. Walker, W. H.; Copley, L. A. (Chalk River Nuclear Labs., Ont.). Can. J. Phys., 44: 1985-93(Sept. 1966). (AECL-2471).

The cadmium ratio method was used to determine the ratio $I'/\sigma_0$ for activation of $^{103}$Rh, where $I'$ is the reduced resonance integral and $\sigma_0$ is the 2.200-m/s cross section. For the production of $^{104g}$Rh $I'/\sigma_0 = 8.1 \pm 0.3$; and, for the production of $^{104m}$Rh, $I'/\sigma_0 = 7.4 \pm 0.3$. These results disagree with a value of ~3.5 obtained in an earlier cadmium ratio measurement. The half-lives of the two isomers were also measured. The thermal cross sections are normalized to an absorption cross section in $^{103}$Rh of 146 barns and a value of 12.2 for the production $^{104g}$Rh relative to $^{104m}$Rh per $^{103}$Rh capture. (auth)

**44690** THE LEVEL STRUCTURE OF $^{104}$Rh OBSERVED IN THERMAL NEUTRON CAPTURE. Hughes, L. B.; Kennett, T. J.; Prestwich, W. V. (McMaster Univ., Hamilton, Ont.). Can. J. Phys., 44: 2041-51(Sept. 1966).

The capture gamma spectrum of the reaction $^{103}$Rh(n,γ)$^{104}$Rh was studied using a Ge(Li) spectrometer. The energy range covered was from 3.6 to 7.5 Mev with an average resolution of 12 kev. A total of 100 transitions were observed, and the neutron separation energy was found to be 6.999 ± 3 kev. (auth)

**44691** ISOSPIN POTENTIAL TERM WITH LOCAL AND NONLOCAL INTERACTIONS. Sood, P. C. (Univ. of Alberta, Edmonton). Can. J. Phys., 44: 2053-7(Sept. 1966).

The isospin-dependent term in the nuclear potentials using nonlocal interaction is related to the corresponding term using local interaction employing the Perey-Buck local approximation. Relations are derived corresponding to two choices, with one choice corresponding to the same energy dependence of the neutron the proton potentials and the other choice corresponding to the same range of nondescription results if the potentials are written as $V_0(1 \pm \tau(N - Z)/A)$. For a given isospin dependence of the phenomenological local potential, the modification introduced is significantly different for the two choices; the importance of undertaking an analysis of the proton-scattering data with nonlocal potentials with a view to clarifying the situation is pointed out. (auth)

**44692** A COMPLETE VARIATIONAL WAVE FUNCTION FOR THE GROUND STATE OF $^3$H AND $^3$He. Banville, Marcel (Univ., Sherbrooke, Que.); Kunz, P. D. Can. J. Phys., 44: 2095-2110(Sept. 1966). (UCOL-535-556).

The three-body wave function for particles of equal mass is expanded in a systematic way by making use of a hyperspherical coordinate system. Apart from the center-of-mass coordinates, three of the variables are the usual Euler angles describing the orientation of the plane defined by the three particles. The other three variables, which describe the shape of the triangle, are represented in terms of a radial coordinate and two angular coordinates. The kinetic energy for these last three coordinates is separable and allows one to expand the three-body wave function in a complete set of orthogonal functions based upon the angular variables. The particular symmetry of the internal part of the wave function under permutations of the three particles is easily represented in terms of the set of functions for one of the angular variables. By choosing a particular set of radial functions one can then obtain the upper limit on the binding energy for the three-body system through the Rayleigh-Ritz variational procedure. The advantage of this particular coordinate system is that all but a few of the variational parameters occur linearly in the wave function, and the minimum energy can be obtained by diagonalizing a small number of the energy matrices. The method is applied to find the lower limit to a standard spin-independent potential of Gaussian shape. (auth)

**44693** NEUTRON-CAPTURE $\gamma$-RAY STUDIES IN $^{50}$Cr(n,$\gamma$)$^{51}$Cr. Bartholomew, G. A.; Earle, E. D.; Gunye, M. R. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys., 44: 2111-30(Sept. 1966). (AECL-2481).

Level energies and the details of the $\gamma$ decay scheme in $^{51}$Cr were determined using a Ge(Li) spectrometer and angular correlation techniques. Spin $^3/_2$ is assigned to levels at 0.748, 1.898, 2.893, 3.125, and 3.769 Mev. A level at 776 kev, for which spin $^1/_2{}^-$ is favored, may account for the anomalous lifetime previously reported for the 748-kev $\gamma$ ray in $^{51}$Cr. (auth)

**44694** CALCULATION OF ROTATION GAMMA-VIBRATION INTERACTION IN TRANSURANIC NUCLEI. Radojevic, Vojislav (Univ. of Belgrade. Boris Kidric Inst. of Nuclear Sciences, Belgrade). Can. J. Phys., 44: 2176-9(Sept. 1966).

Numerical calculations based on the Nilsson plus the pairing force model of internal motion of nuclei and the assumption of separate neutron and proton degrees of freedom of $\gamma$-vibration were performed for several nuclei of the rare-earth region. Qualitative agreement between numerical and experimental results appeared to be very much improved by giving up the assumption of separate $\gamma$-vibrational degrees of freedom. (F.S.A.)

**44695** ADDITION TO THE HYPERFINE STRUCTURE THEORY. Ionesco-Pallas, Nicolas J. (Inst. for Atomic Physics, Bucharest). Compt. Rend., Ser. B, 263: 99-102 (July 11, 1966). (In French).

It is shown that the nuclear magnetic moments obtained from the hyperfine structure are systematically smaller than those obtained by nuclear induction. The difference in the results of these two methods is a function of Z. This function is determined by analyzing the experimental data in the light of the proposed theory. (tr-auth)

**44696** EXISTENCE OF SATELLITE BANDS IN THE SPECTRA OF INTERNAL CONVERSION ELECTRONS. Valadares, Manuel; Walen, Robert J.; Briancon, Chantal (CNRS, Orsay, France). Compt. Rend., Ser. B, 263: 313-16(July 25, 1966). (In French).

The existence of satellite bands in the spectra of internal conversion electrons produced in highly ionized atoms following a conversion is established for the transmutation $^{277}$Th → $^{223}$Ra. (G.O.Y.)

**44697** TRAPPING OF THE SOLAR WIND IN SOLIDS. PART I. TRAPPING PROBABILITY OF LOW-ENERGY He, Ne, AND Ar IONS. Buehler, F. (Univ. of Bern); Geiss, J.; Meister, J.; Eberhardt, P.; Hunek, J. C.; Signer, P. Earth Planet. Sci. Lett., 1: 249-55(Sept. 1966).

The trapping probability in Al foils of He, Ne, and Ar ions with energies between 0.46 and 7 kev was determined. Argon is trapped quantitatively for ion energies higher than 2.5 kev. At 2.5 kev the trapping probabilities of neon and helium are about 0.6. For lower energies the trapping probability of argon decreases rapidly. No saturation effects were observed for integrated bombardment fluxes up to $2 \times 10^{14}$ Ar ions/cm$^2$ at 2.5 kev and $3 \times 10^{13}$ Ar ions/cm$^2$ at 0.46 kev. The trapped gases are held quite firmly. Foils bombarded with ions of 2.5 and 7.5 kev were heated at 200 and 400°C for times up to 650 hours. Only 10−20% of the helium and virtually no neon and argon were lost at 200°C. However, at 400°C, gas losses become quite serious within 24 hours. These results show that an Al foil exposed to the solar wind would trap and retain a large fraction of the solar wind ions. (auth)

**44698** STATISTICAL MODEL OF THE NUCLEUS. Kisdi, David (Theoretical Physics Research Group, Academy of Sciences, Hungary). Fiz. Szemle, 16: 205-9(June 1966). (In Hungarian).

The Fermi-gas model of the nucleus is based on the statistical theory of the electron cloud of atoms and molecules. The nucleus is subdivided into space elements which are small enough to possess a constant nucleon density but contain a sufficiently large number of nucleons to be treated as a nucleon gas; these contradictory requirements must be adjusted by compromise. The basic problem of the model consists in the determination of the internal energy E of the nucleus as a function of proton and neutron densities and of the neutron densities at which E is a minimum. These neutron densities correspond to the stable equilibrium state of the nucleus; the E value represents its bond energy. The values calculated on the basis of the model were found to agree with experimental data. Further development of the model should be directed toward finding an approximate solution of the dependence of the semi-empirical K(1,2) interaction on the neutron density and toward the determination of the inhomogeneity correction of the interaction energy. (TTT)

**44699** GROUP-THEORETICAL APPROACH TO THE PAIRING INTERACTION IN THE TRANSLATIONALLY INVARIANT SHELL MODEL. Sheldon, Eric; Herrmann, Christoph (Eidgenoessische Technische Hochschule, Zurich). Helv. Phys. Acta, 39: 397-403(Aug. 15, 1966).

The group-theoretical approach to classification of shell-model states for a translationally invariant model with a 3A-dimensional harmonic oscillator potential, where A represents the number of constituent nucleons, is extended by the consideration of an interaction which takes account of orbit-pair correlation and spin-orbit pair correlation by the use of Racah and Flowers groups respectively (in place of the SU(3) scheme employed hitherto), and which in consequence offers a more general and realistic treatment. (auth)

**44700** DECAY OF $^{192}$Ir. Schellenberg, L.; Kern, J. (Univ. of Fribourg, Switzerland). Helv. Phys. Acta, 39: 420-38(Aug. 15, 1966). (In German).

The decay of 74.4-day $^{192}$Ir was studied using a double-focusing beta spectrometer. Both internal and external conversion electrons were detected. The corresponding conversion coefficients were obtained by normalizing the conversion and photon intensities using the theoretical (Sliv and band) conversion coefficient for the $2' - 0$ transition. Information on transition multipolarities was obtained, and some previously unreported lines were observed. Modifications of the previously reported level schemes of $^{192}$Os and $^{192}$Pt are proposed; the schemes are compared with the predictions of different collective models. (D.C.W.)

**44701** L SUBSHELL RATIOS OF E2 TRANSITIONS IN DEFORMED RARE EARTH NUCLEI. Brantley, W. H.; Pancholi, S. C.; Hamilton, J. H. (Vanderbilt Univ., Nashville). Indian J. Phys., 40: 169-77(Apr. 1966).

The L subshell ratios of the $2^+$ to $0^+$ first excited state to ground-state transitions in $^{154}$Gd, $^{170}$Yb, and $^{182}$W were measured with an iron-free double-focusing spectrometer. The results indicate that the $L_1/L_2$ and $L_1/L_3$ ratios are about 15% or more higher than the theoretical values while $L_2/L_3$ ratios agree with the theories of Rose and of Sliv and Band. (auth)

**44702** $\Lambda$-BINDING ENERGIES OF HYPERNUCLEI. I. Dutta, A. K.; Banerjee, D.; Ganguly, P. (Univ. Coll. of Science, Calcutta). Indian J. Phys., 40: 178-80(Apr. 1966).

It is considered that the $\Lambda$-binding energy of a hypernucleus is related closely to the maximum binding energy of a nucleus with the same nucleon number as the particle number in the $\Lambda$-hypernucleus. The ratio between the $\Lambda$-binding energy and the binding energy E* of the corresponding nucleus, gives a smooth curve of the nature of a probability function when drawn against nucleon numbers. The curve may be expressed by the relation: $\Lambda_{B\epsilon} = E^*A^3 \exp[-\chi(A)]$. It is observed on comparison that the function $\chi(A)$ is representable in the form $(\alpha E_n^0(A) - \beta)$, where $E_n^0(A)$ is the ground-state energy per nucleon, uncorrected by coulomb and asymmetry energies. The empirical finding suggests a statistical approach to nucleonic interactions. (auth)

**44703** NON-DEGENERATE STATISTICAL APPROACH TO THE BINDING ENERGY OF NUCLEI AND OF Λ-HYPERNUCLEI. II. Dutta, A. K. (Univ. Coll. of Science, Calcutta). Indian J. Phys., 40: 181-6(Apr. 1966).

The binding energy per nucleon of a hypothetical nucleus, without the coulomb and asymmetry energy corrections, is considered to be the mean value of neutron-proton interaction energy between neighbors. The numbers of neutrons and protons in the hypothetical nucleus are considered to be equal (to be modified when coulomb and asymmetry energies are taken into account) and thus the binding energy per nucleon, $E_n^0(A)$, is considered to be approximately constant for all the nucleons in a nucleus. In momentum space, these nucleons are considered to be contained in different momentum shells, according to the nucleon numbers in the nucleus. This gives rise to the total number of combination states in different nuclei, which along with the modified nondegenerate Fermi distribution function determines the probable number of occupied states. To correspond to the required values of $E_n^0(A)$ the parameters in the relation are determined. The statistical relation, read as a relation to determine binding energy of neutrons, helps in finding the relation for the binding of Λ-particles, in accordance with the one required empirically. (auth)

**44704** LIFETIMES OF 158 AND 208 kev. LEVELS OF $^{199}$Hg. Rao, B. V. Narasimha; Jnanananda, Swami (Andhra Univ., Waltair, India). Indian J. Pure Appl. Phys., 4: 269-71(1966).

The lifetimes of the 158- and 208-kev levels of $^{199}$Hg measured with a fast time-to-amplitude converter, are 2.37 ± 0.07 nsec and $7.13 \pm 0.7 \times 10^{-11}$ sec respectively. The transition probabilities calculated from the lifetimes were compared with the core excitation model predictions. A good agreement is observed between the two. (auth)

**44705** DIRECTIONAL CORRELATION STUDIES IN $^{125}$Sn → $^{125}$Sb DECAY. Devare, S. H.; Devare, H. G. (Tata Inst. of Fundamental Research, Bombay). Indian J. Pure Appl. Phys., 4: 217-20(June 1966).

Gamma-gamma and beta-gamma directional correlation measurements were made with a view to making definite spin assignments to levels of $^{125}$Sb fed in the decay of the 9.7-day activity of $^{125}$Sn. The beta spectrum in coincidence with the 1075-kev gamma ray, studied with a $4\pi$ plastic scintillator, showed a deviation from the statistical shape while the spectrum in coincidence with the 1410-kev gamma ray did not show any such deviation. The beta-gamma directional correlation with the photopeak of the 1075-kev gamma ray and 960−1060 kev region of the beta spectrum in gate was seen to be of the form $W(\theta) = 1 + (0.031 \pm 0.01)\, P_2 (\cos\theta)$. The directional correlation functions for various gamma cascades were as follows: (910−1075 kev), $W(\theta) = 1 + (0.1415 \pm 0.0075)\, P_2 \cos\theta + (0.0034 \pm 0.0112)\, P_4 \cos\theta$; (810−1075 kev), $W(\theta) = (0.14 \pm 0.0075)\, P_2 \cos\theta + (0.004 \pm 0.0112)\, P_4 \cos\theta$; (335−1075 kev), $W(\theta) = 1 - (0.05 \pm 0.012)\, P_2 \cos\theta + (0.016 \pm 0.016)\, P_4 \cos\theta$. The directional correlations for the 335−475 and 475−1410 kev cascades were found to be isotropic. Analysis of the data shows that the beta transition to the 1075-kev level is not a first-forbidden unique transition as suggested by the log ft value and the deviation from the statistical shape. The following two spin sequences for the levels of $^{125}$Sb are consistent with these measurements: 1075 kev ($^{11}/_2$), 1410 kev ($^9/_2$), 1885 kev ($^{11}/_2$), and 1985 kev ($^{11}/_2$); or 1075 kev ($^9/_2$), 1410 kev ($^{11}/_2$), 1885 kev ($^9/_2$ or $^{11}/_2$), and 1985 kev ($^9/_2$ or $^{11}/_2$). (auth)

**44706** A NEW ESTIMATION OF $^{144}$Xe HALF-LIFE. Lazzarini, E.; Terrani, M. (Politecnico, Milan). Int. J. Appl. Radiat. Isotop., 17: 554-6(Sept. 1966).

The half life of xenon-144 was estimated in the course of experiments on the distribution of fission products between the core and the recombined of a water boiler reactor. The estimation was based on the measurement of xenon-144 decay probability in recombiner through the measurement of cerium-144 activity in the recombiner water and the application of devised mathematical relationships. The decay probability in recombiner of xenon-144 was found to be 0.111 ± 0.018. The half life was calculated to be 8.8 ± 2.2 sec. (J.G.B.)

**44707** ANALYTIC PROPERTIES OF RESOLVENTS AND COMPLETENESS. Fonda, L.; Ghirardi, G. C.; Weber, T. (Univ., Trieste, Italy). J. Math. Phys., 7: 1643-7(Sept. 1966).

The completeness of the set of eigenstates of a non-Hermitian operator whose resolvent satisfies certain physically plausible analytic properties is proved by using a simple formal procedure. It is also shown how the obtained completeness relation can be related to the scattering solutions of the eigenvalue equation with extension to the multichannel case. All proofs are heuristic only. (auth)

**44708** THERMAL NEUTRON-INDUCED FISSION CROSS SECTION OF $^{242m}$Am. Wolfsberg, K.; Ford, G. P.; Smith, H. L. (Los Alamos Scientific Lab., N. Mex.). J. Nucl. Energy: Pt. A and B, 20: 588-90(July 1966).

A value of 7200 ± 300 barns was obtained for the thermal neutron fission cross section of $^{242m}$Am by comparison fission counting with $^{235}$U as a standard. Details and results of the measurements are given. (L.B.S.)

**44709** PRODUCTION AND STUDY OF THE ISOMERS $^{179m}$Hf AND $^{177m}$Yb. Vergnes, M.; Ronsin, G.; Kalifa, J.; Rotbard, G. (Institut du Radium, Orsay, France). J. Phys. (Paris), 27: 257-61(May-June 1966). (In French).

The isomers $^{179m}$Hf and $^{177m}$Yb were produced using neutrons from the $^9$Be(d,n)$^{10}$B reaction. A pneumatic transfer tube allowed these short-lived activities to be studied. Each isomeric level decays by $M_3$ and $E_1$ gamma rays in cascade. Conversion coefficients were measured, and the intermediate level half life was determined to be 2.0 ± 0.2 nsec for $^{179}$Hf and 4.15 ± 0.3 nsec for $^{177}$Yb. The $E_1$ transition probabilities are compared with the Nilsson model theoretical predictions, taking into account the pairing force. (auth)

**44710** STUDY OF THE DEFORMATION OF THE HOLMIUM NUCLEUS. Axel, P.; Miller, J.; Schuhl, C.; Tamas, G.; Tzara, C. (Centre d'Etudes Nucleaires, Saclay, France). J. Phys. (Paris), 27: 262-8(May-June 1966). (In French).

An experiment is described which was performed to study the photodisintegration of the deformed nucleus $^{165}$Ho in the giant dipole resonance region. The total photoneutron cross section and the $(\gamma,2n)$ cross section were measured from the $(\gamma,n)$ threshold to 19.6 Mev using monochromatic gamma rays obtained by annihilation in flight of positrons. The total absorption cross section of photons is deduced assuming the $(\gamma,p)$ cross section to be negligible. The integrated cross section obtained is $\sigma_{nt}$ (9 − 19.6 Mev) = 2.54 Mev-b. From the shape of the cross section the value $Q_0 = 7.4 \pm 0.4$ b is deduced for the quadrupole moment. The elastic scattering of gamma rays was measured for gamma rays of energies 12.6 and 16.4 Mev and the two scattering angles 90 and 135°. (auth)

**44711** ENERGY SPECTRA AND ANGULAR DISTRIBUTIONS OF NUCLEONS IN THREE-PARTICLE PHOTODISINTEGRATION OF THE $^3$He NUCLEUS. Dzhibuti, R. I.; Mamasakhlisov, V. I.; Macharadze, T. S. (Inst. of Physics, Academy of Sciences, Georgian SSR). JETP Lett. (USSR) (Engl. Transl.), 4: 107-9(Aug. 15, 1966).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Redaktsiyu, 4: 156-9(Aug. 15, 1966).

The spectra of the neutrons in the photodisintegration

$\gamma + {}^3He \rightarrow p + p + n$ are discussed and compared with earlier results. Also the spectra of the protons and the angular distributions of the photonucleons are described. (M.O.W.)

**44712** HALF-LIVES OF $^{137m}$Ba, $^{109m}$Ag, AND $^{106}$Rh MEASURED WITH CALCULABLE OVERALL ACCURACY. Middelboe, V. (Royal Veterinary and Agricultural Coll., Copenhagen). Nature, 211: 283-4(July 16, 1966).

The half lives of $^{137m}$Ba, $^{109m}$Ag, and $^{106}$Rh were determined with a known degree of contaminational uncertainty. (D.C.W.)

**44713** REVISED A CHAINS. A = 186: Ta, W, Re, Os, Ir, Pt, Au, AND Hg. Gove, N. B. (comp.). Nucl. Data, B1: No. 2, 1-22(June 1966).

Level schemes, compilers' analysis sheets, and data sheets are given for nuclei with A = 186. The associated references are also included. (D.C.W.)

**44714** REVISED A CHAINS. A = 187: W, Re, Os, Ir, Pt, Au, AND Hg. Ewbank, W. B. (comp.). Nucl. Data, B1: No. 2, 23-52(June 1966).

Level schemes, compilers' analysis sheets, and data sheets are given for nuclei with A = 187. The associated references are also included. (D.C.W.)

**44715** REVISED A CHAINS. A = 188: W, Re, Os, Ir, Pt, Au, AND Hg. Martin, M. J. (comp.). Nucl. Data, B1: No. 2, 53-84(June 1966).

Level schemes, compilers' analysis sheets, and data sheets are given for nuclei with A = 188. The associated references are also included. (D.C.W.)

**44716** REVISED A CHAINS. A = 189: W, Re, Os, Ir, Pt, Au, AND Hg. Artna, A. (comp.). Nucl. Data, B1: No. 2, 85-107(June 1966).

Level schemes, compilers' analysis sheets, and data sheets are given for A = 189. The associated references are also included. (D.C.W.)

**44717** PREPARATION OF $^{24}$Mg FROM $^{24}$MgO. **Chellew, N. R.; Steunenberg, R. K.; Schilb, J. D. (Argonne National Lab., Ill.). Nucl. Instrum. Methods, 44: 149-50(Sept. 1966).**

Isotopically pure $^{24}$Mg was prepared by the thermal reduction of $^{24}$MgO. The method used involved the simultaneous high-temperature (1150°C) reaction of $^{24}$MgO with Al and CaO and vaporization of the product metal in vacuum. (D.C.W.)

**44718** DETERMINATION OF PEAK LOCATIONS OF PURE AND COMPLEX PHOTOPEAKS. Mundschenk, H. **(Univ., Mainz). Nucl. Instrum. Methods, 44: 325-34(Oct. 1966). (In German).**

To determine the center of photopeaks normally occurring in $\gamma$-spectra in complex form, some modified methods are developed for most typical cases: single peak and constant background; single peak and exponentially decreasing background; two overlapping peaks at different distances of energy and varying peak intensities. The statistical fluctuations can be widely eliminated by use of a simple averaging method, so that peak center locations can be evaluated even in the case of relatively small peak intensities. Applying the methods proposed to some cases of strongly overlapping photopeaks, excellent agreement between the theoretical and experimentally obtained values could be achieved. (auth)

**44719** PION SCATTERING ON NUCLEI. Ramachan**dran, G. (Indian Statistical Inst., Calcutta). Nucl. Phys., 87: 107-20(1966).**

Elastic scattering of pions on $^7$Li is studied using a general method which exactly takes into consideration the initial and final nuclear spins and the type of angular momentum coupling; the impulse approximation discussion is also extended to double-charge exchange scattering of pions. Numerical results are presented using oscillator and square well wave functions, which are compared with available experimental data at 80 Mev. (auth)

**44720** RESULTS FROM LOW-ENERGY, INTRANUCLEAR-CASCADE CALCULATION. Bertini, Hugo W. (Oak Ridge National Lab., Tenn.). Nucl. Phys., 87: 138-40(1966). (ORNL-TM-1225).

A large quantity of calculated data is available on nuclear reactions resulting from the inelastic interaction of nucleons and $\pi$ mesons on complex nuclei at energies of the order of 200 Mev. The type of data available is described. A separate document that contains complete instructions for obtaining both the data and the computer programs used to generate the data is available upon request. (auth)

**44721** STUDY OF THE CHARGE DISTRIBUTION IN DEFORMED NUCLEI BY MUONIC HYPERFINE STRUCTURE. Acker, H. L. (Univ. of Virginia, Charlottesville). Nucl. Phys., 87: 153-69(1966). (ORO-2915-49).

The effects of different models of the charge distribution of deformed nuclei on the muonic hyperfine structure are studied. It is shown that besides the quadrupole moment at least one additional parameter may be determined, specifying the distribution of the quadrupole-producing charge. A modified Fermi distribution was chosen for the nucleus, where not only the radial parameter c, but also the surface thickness t shows an angular dependence. Besides, the model of a Gaussian quadrupole charge distribution was studied. Numerical calculations were done for $^{238}$U. The sensitivity of the spectra on the parameters was studied. (auth)

**44722** THE DECAY OF $^{95}$Y. **Larson, R. E.; Gordon, C. M. (Naval Research Lab., Washington, D. C.). Nucl. Phys., 88: 481-91(1966).**

The beta and gamma spectra associated with the decay of $^{95}$Y were measured using scintillation spectrometers. A decay scheme based on these measurements and on coincidence data was proposed. A $^{95}$Y half life of 10.3 ± 0.1 min was measured. Gamma rays were found at 0.30, 0.43, 0.96, 1.08, 1.19, 1.33, 1.63, 1.82, 1.95, 2.18, 2.34, 2.63, 2.80, 3.13, 3.26, 3.43, and 3.555 Mev. The highest-energy beta transition is 4.3 ± 0.1 Mev to the ground state of $^{95}$Zr. It comprises about 40% of the beta decay and has a log ft value of 7.0, indicating a first-forbidden, $\Delta I = 2$ (yes), transition from a $p_{1/2}^{-}$ ground state in $^{95}$Y to a $d_{5/2}^{+}$ ground state in $^{95}$Zr. Other beta transitions with end-points at 1.17 and 0.76 Mev were adequately resolved, but weaker transitions at 3.4, 2.7, and 1.7 Mev were only tentatively assigned to $^{95}$Y. Levels were established in $^{95}$Zr from the decay of $^{95}$Y and were compared to the levels observed in (d,p) and (d,t) reactions. (auth)

**44723** THE REACTION $^9$Be($\alpha$,n)$^{12}$C. Miller, Richard G.; Kavanagh, R. W. (California Inst. of Tech., Pasadena). Nucl. Phys., 88: 491-500(1966).

Using a stilbene crystal as a neutron detector, the $0^0$ cross section for the reaction $^9$Be($\alpha$,n) was measured as a function of bombarding energy for $n_0$ ($5.0 \leq E_\alpha \leq 12.0$ Mev), $n_1$ ($4.3 \leq E_\alpha \leq 12.0$ Mev) and $n_2$ ($6.0 \leq E_\alpha \leq 10.1$ Mev). Resonances in the ground-state neutron yield corresponding to levels in $^{13}$C were seen at the following $\alpha$-bombarding energies stated in Mev (with resonance widths in kev): 5.40 (240), 6.20 (400), 7.10 (210), 7.95 (240), 9.10 (380), 9.7 (140), 10.2 (280), 11.10 (400), and 11.70 (80). (auth)

**44724** NOTES ON DOPPLER-SHIFT LIFETIME MEASUREMENTS. **Blaugrund, A. E. (Argonne National Lab., Ill.). Nucl. Phys., 88: 501-12(1966).**

By use of the universal scattering cross section derived by Lindhard, the velocity of an ion in a scattering medium is calculated as a function of time. The effect of both electronic and atomic collisions is included. In addition, the average scattering angle (in the lab system) resulting from multiple atomic collisions is derived. It is shown that in most cases the attenuation of the Doppler shift as a result of the changed direction of the scattered nucleus is more important than the effect of slowing down due to atomic collisions. In fact, at low velocities and for heavy scatterers, the change in the direction of motion is the dominating factor. The results are given in a form amenable to numerical analysis. In the limiting cases of very short lifetimes and of predominantly electronic scattering, the average Doppler shifts are given in an analytical form. (auth)

**44725** STUDY OF THE $^{25}$Mg(d,p)$^{26}$Mg REACTION AT 8.0 Mev. Lutz, H. F.; Eccles, S. F. (Univ. of California, Livermore). Nucl. Phys., 88: 513-22(1966). (UCRL-14867).

The $^{25}$Mg(d,p)$^{26}$Mg reaction at 8.0 Mev incident deuteron energy was studied. Data were obtained down to $0^0$ with respect to the incident beam. Complete angular distributions were obtained for transitions leading to the ground state of $^{26}$Mg and excited states at 1.81, 2.94, and 3.94 Mev. The state at 3.58 Mev was excited very weakly and was seen in only a few spectra. Integrated cross sections were obtained by fitting the experimental data by a sum of Legendre polynomials. The angular distributions were analyzed in terms of the DWBA. The angular distribution of the transition leading to the ground state of $^{26}$Mg has the shape of a single l = 2 stripping pattern. The other angular distributions require a sum of l = 0 and l = 2 stripping curves. The spectroscopic factors are compared with the theoretical predictions of the quasi-molecular model. (auth)

**44726** PHOTOPRODUCTION AND β-DECAY OF $^{8}$He. Nefkens, B. M. K.; Sutton, D. C.; Thompson, M. N. (Univ. of Illinois, Urbana). Nucl. Phys., 88: 523-8(1966).

The $^{8}$He nucleus was produced by irradiating natural boron with 250-Mev bremsstrahlung and was detected by means of β-γ coincidences. The half life of $^{8}$He was found to be 114 ± 25 msec. The cross section per effective quantum for the production of $^{8}$He decaying to the 0.98-Mev level in $^{8}$Li is 0.08 ± 0.04 μb/Q for 250-Mev bremsstrahlung on $^{11}$B. (auth)

**44727** NUCLEON SEPARATION ENERGY BY K-MATRIX THEORY. Koehler, H. S. (Rice Univ., Houston, Tex.). Nucl. Phys., 88: 529-38(1966).

The widths of resonances observed in (p,2p) and (e,e′p) experiments are supposed to be due to the finite lifetimes of hole-states created in these experiments and are calculated as a function of the momentum of the hole in infinite nuclear matter. The decay of the hole-state is assumed to occur by two-body, K-matrix interactions. Then the calculation involves the imaginary part of the second-order rearrangement potential. Widths of 1s hole states for finite nuclei are obtained from the infinite system calculations by an approximate procedure. Good agreement with the observed 1s widths for small nuclei is obtained. A width of 22 Mev for a 1s hole in $^{40}$Ca and a width of 29 Mev for a 1s hole in $^{208}$Pb is predicted. The experimental separation energies for nucleons in $^{12}$C, $^{16}$O, and $^{27}$Al in conjunction with the experimental binding and calculated kinetic energies of these nuclei are shown to indicate large rearrangement energies. When averaged over single-particle states, the following values are obtained: $^{12}$C : 11 Mev, $^{16}$O : 8 Mev, and $^{27}$Al : 3.7 Mev. The decrease with mass number can be understood. The absolute values are in reasonable agreement with, or possibly somewhat larger than, what is expected in view of the rearrangement energies calculated for the infinite system. The third-order, hole-hole rearrangement energy contribution for a zero-momentum nucleon in an infinite medium is calculated to be ≈ 2.5 Mev as compared to ≈ 20 Mev for the second-order rearrangement energy. (auth)

**44728** STUDIES OF THE $^{12}$C($^{3}$He,$^{3}$He)$^{12}$C AND $^{12}$C($^{3}$He,$\alpha_0$)$^{11}$C REACTIONS. Schwartz, J. J.; Alford, W. P.; Blau, L. M.; Cline, D. (Univ. of Rochester, N. Y.). Nucl. Phys., 88: 539-47(1966). (UR-875-141).

Angular distributions of emergent $^{3}$He and $^{4}$He particles from the $^{12}$C($^{3}$He,$^{3}$He)$^{12}$C and $^{12}$C($^{3}$He,$\alpha_0$)$^{11}$C reactions were measured at several energies from 8.5 to 10.0 Mev. Excitation functions for these reactions were measured at laboratory angles of 15, 45, and 75°. Distorted-wave calculations were performed, with the optical model parameters for the entrance channel being obtained from the elastic scattering results and those for the exit channel being varied to obtain the best fit. The calculations provide satisfactory fits to the observed shape of the elastic and reaction angular distributions. The magnitude of the cross section is substantially greater than predictions, however. (auth)

**44729** A STUDY OF THE $^{59}$Co(n,γ)$^{60}$Co REACTION. Prestwich, W. V.; Kennett, T. J.; Hughes, L. B. (McMaster Univ., Hamilton, Ont.). Nucl. Phys., 88: 548-60 (1966).

The gamma radiation from the $^{59}$Co(n,γ)$^{60}$Co reaction was studied using a Ge(Li) spectrometer. A total of 122 transitions was observed, and their intensity and energy was determined. The neutron separation energy of 7495 ± 5 kev was obtained. The level structure of $^{60}$Co was determined from the primary transitions and was compared to those revealed in charged-particle spectra. A decay scheme was constructed for some of the lower-lying levels. An observed dependence of partial radiative widths on the final state structure is discussed. (auth)

**44730** NUCLEAR STRUCTURE OF $^{16}$N. Hewka, P. V.; Holbrow, C. H.; Middleton, R. (Univ. of Pennsylvania, Philadelphia). Nucl. Phys., 88: 561-75(1966).

The excitation energies of 36 levels of $^{16}$N below 8.4 Mev were determined by high-resolution studies of the $^{14}$N(t,p)$^{16}$N, $^{15}$N(d,p)$^{16}$N, and $^{18}$O(d,α)$^{16}$N reactions. Angular distributions were measured for all levels observed in the $^{14}$N(t,p)$^{16}$N reaction. Several new spin and parity assignments were made, and two states were identified as the $(1p_{1/2})^{-1}\,1d_{5/2}$ single-particle levels. (auth)

**44731** DIRECT DETERMINATION OF A SHORT NUCLEAR LIFETIME (≈ $10^{-20}$s) BY THE PROXIMITY SCATTERING METHOD. Lang, J.; Mueller, R.; Woelfli, W.; Boesch, R.; Marmier, P. (Edigenoessiche Technische Hochschule, Zurich). Nucl. Phys., 88: 576-92(1966).

A nuclear reaction with three outgoing particles can proceed in two sequential stages, one of the product particles (R) of the first step being unstable. Under certain conditions, two of the three particles in the final state can undergo a further nuclear reaction ("proximity scattering"). The probability for such a process to occur depends on the lifetime of the unstable particle R, as shown by a simple classical analysis. A quantal estimate of the proximity scattering cross section is presented, and an experiment is described in which the correlations between the protons and neutrons of the reaction $^{12}$C(d,pn)$^{12}$C at a deuteron energy of 5.39 Mev were measured. A lifetime of $\tau = 0.7 \times 10^{-20}$ sec can be assigned to the level group at 3.5 Mev in $^{13}$N. (auth)

**44732** SCATTERING OF POLARIZED NEUTRONS BY α PARTICLES. Buesser, F. W. (Institut fuer Experimentalphysik, Hamburg); Niebergall, F.; Soehngen, G.; Christiansen, J. Nucl. Phys., 88: 593-601(1966).

The angular variation of the asymmetry in the elastic scattering of partially polarized neutrons by helium was measured for neutron energies of 12.0 and 16.2 Mev. The experimental results are compared to the predictions of various sets of scattering phase shifts. The reactions $^{15}$N(d,n)$^{16}$O and $^{3}$H(d,n)$^{4}$He are used as sources of partially polarized neutrons. The measurements yielded a polarization value of −0.463 ± 0.020 for the $^{15}$N(d,n) source (bombarding energy 2.6 Mev, reaction angle 45° lab) and of −0.223 ± 0.009 for the $^{3}$He(d,n) source (bombarding energy 2.9 Mev, reaction angle 75° lab). (auth)

**44733** $\beta^+$ RADIOACTIVITY OF $^{30}$S. Gallmann, A.; Frick, G.; Alburger, D. E.; Aslanides, E. (Institut de Recherches Nucleaires, Strasbourg). Nucl. Phys., 88: 602-8(1966). (In French).

The gamma spectrum from the decay of $^{30}$S, measured with a Ge(Li) detector, shows only a 678 ± 2 kev gamma ray, corresponding to the decay of the first excited state of $^{30}$P. Lower limits for the intensities of other gamma rays are given, and the corresponding β-decay branching ratios are calculated. (auth)

**44734** ANALYSIS OF THE BCS GROUND STATE FOR A CHARGE-INDEPENDENT PAIRING INTERACTION.

Flores, J. **(Princeton Univ., N. J.); Mello, P. A. Nucl. Phys., 88: 609-23(1966).**

The nature of the approximations involved in the BCS method applied to a system of protons and neutrons in a single j-shell, interacting through a charge-independent pairing force is analyzed by comparing the trial BCS ground-state wave function with the exact solution. (auth)

**44735** VIBRATIONAL STATES OF $^{152}$Sm AND $^{154}$Gd POPULATED BY THE ($\alpha$,2n) REACTION. Loensjoe, O.; Hagemann, G. B. (Univ. of Copenhagen). Nucl. Phys., 88: 624-40(1966).

Spectra of prompt internal conversion electrons with energies up to 2 Mev were obtained from targets of $^{150}$Nd, $^{152}$Sm, and $^{154}$Sm bombarded with alpha particles of energies from 18 to 20.5 Mev. At these bombarding energies the ($\alpha$,2n) reaction is dominant, and most of the prominent low-energy lines could be ascribed to cascade transitions in the ground-state rotational bands of the final nuclei $^{152}$Sm, $^{154}$Gd, and $^{156}$Gd, which were populated up to spin 10 or more. Series of other strong lines at higher energy were interpreted as monopole enhanced transitions from states in excited $K = 0$ $\beta$-vibrational bands to states of the same spin in the ground-state bands. Levels in these $K = 0$ bands were identified up to spin 10 in $^{154}$Gd and spin 12 in $^{152}$Sm. Matrix elements for monopole transitions from levels in the excited $K = 0$ bands were obtained from the ratio between the intraband E2 transition rate and the E0 interband rate and also from the ratio of the E0 to E2 interband transition rates. Gamma-electron coincidence spectra were also measured. Values of the mixing parameter z were determined for several excited states. (auth)

**44736** ENERGY LEVELS AND ROTATION-PARTICLE COUPLING IN $^{155}$Eu. **Funke, L. (Bereich Kernphysik, Dresden); Graber, H.; Kaun, K. H.; Sodan, H.; Frana, J. Nucl. Phys., 88: 641-53(1966). (In German).**

The $\gamma$ spectrum from the decay of $^{155}$Sm was measured using a Ge(Li) detector. The present data confirm the decay scheme of $^{155}$Sm, which was proposed earlier as a result of scintillation measurements. In addition several previously unreported $\gamma$ transitions were found, and a level at 1226 kev was introduced in the level scheme of $^{155}$Eu. An analysis with the improved energy and intensity data shows that in $^{155}$Eu just as in $^{153}$Eu a rotation-particle-coupling of the bands $3/2^+[411]$ and $5/2^+[413]$ is present. The matrix element $A_K$ for this coupling has an experimental value of about 15 kev. The anomalous rotational constants $\hbar^2/2\mathscr{I}$ of 9.0 and 7.74 kev for the $5/2^-[532]$ band in $^{155}$Eu and $^{153}$Eu point to coupling with the $7/2^-[523]$ band. (auth)

**44737** ANALYSIS OF THE REACTIONS $^{25}$Mg(p,p)$^{25}$Mg AND $^{24}$Mg(d,p)$^{25}$Mg AT 5 AND 6 Mev. **Gallmann, A. (Institut de Recherches Nucleaires, Strasbourg); Wagner, P.; Franck, G.; Wilmore, D.; Hodgson, P. E. Nucl. Phys., 88: 654-74(1966).**

Measurements were made of the reactions $^{25}$Mg(p,p)$^{25}$Mg, $^{25}$Mg(p,p')$^{25}$Mg to several states of $^{25}$Mg at proton energies of 5 and 6 Mev and of $^{24}$Mg(d,p)$^{25}$Mg to five states of $^{25}$Mg at deuteron energies of 5 and 6 Mev. The elastic and inelastic scattering data were analyzed using the optical model and the Hauser-Feshbach theory, with and without the width fluctuation correction, and the (d,p) stripping data were analyzed using the DWBA. (auth)

**44738** FLUCTUATIONS OF THE CROSS SECTIONS OF THE REACTIONS **$^{25}$Mg(p,p)$^{25}$Mg AND $^{24}$Mg(d,p)$^{25}$Mg. Gallmann, A. (Institut de Recherches Nucleaires, Strasbourg); Wagner, P.; Hodgson, P. E. Nucl. Phys., 88: 675-88(1966). (In French).**

The differential cross sections of the following reactions were measured at the angles and energies indicated: $^{25}$Mg(p,p)$^{25}$Mg at 120 and 150° for 4.86 to 5.16 Mev in 4-kev steps and for 4.5 to 6.1 Mev in 25-kev steps; $^{25}$Mg(p,p')Mg to three excited states of $^{25}$Mg at 120 and 150° for 4.5 to 6.1 Mev in 25-kev steps; $^{24}$Mg(d,p)$^{25}$Mg to five states of $^{25}$Mg at 40, 80, and 120° for 2.8 to 6.1 Mev in 50-kev steps. The fluctuations in these cross sections are analyzed using the theory of Ericson; and the correlation coefficients, coherence energies, and channel numbers are determined. (auth)

**44739** CONTINUOUS NEUTRON SPECTRA FROM **(p,n) REACTIONS. Borchers, R. R.; Wood, R. M.; Holbrow, C. H. (Univ. of Wisconsin, Madison). Nucl. Phys., 88: 689-96(1966). (COO-7-0396).**

Neutron spectra from the bombardment of $^{89}$Y, $^{93}$Nb, $^{115}$In, $^{139}$La, $^{141}$Pr, $^{181}$Ta, and $^{197}$Au with protons of energies between 8 and 14 Mev were measured by the time-of-flight technique. The data were compared to the predictions of the statistical model but only qualitative agreement was found. The level densities deduced from the data showed an anomalous dependence on bombarding energy which could not be explained. (auth)

**44740** QUASI-ELASTIC NEUTRINO SCATTERING ON NUCLEI. **Piketty, C. A. (Laboratoire de Physique Theorique et Hautes Energies, Orsay, France). Nuovo Cimento (10), 44A: 1163-83(Aug. 21, 1966).**

The muon angular distribution for the neutrino Freon bubble chamber and the $\nu$ spark-chamber experiments were derived. The light nuclei are described by the shell model and the heavy nucleus by the ideal Fermi gas. The nuclear absorption of the recoil nucleon was taken into account. The nuclear parameters have been deduced from p-nucleus experiments. The validity of the approximations was studied by comparing the experimental and theoretical differential cross sections ee'p on carbon. Despite the large experimental incertitude the equality of the axial vector form factor to the electromagnetic one seems to be favored. The muon angular distributions for $\nu$-carbon scattering are given. (auth)

**44741** REMARKS ABOUT INTERFERENCE EFFECTS IN COULOMB AND NUCLEAR SCATTERING OF POLARIZED PROTONS. **Beltrametti, E. (Univ., Genoa, Istituto Nazionale di Fisica Nucleare, Genoa); Boebel, G.; Gigli, A.; Zambotti, G. Nuovo Cimento (10), 44A: 1290-3 (Aug. 21, 1966).**

A discussion is given of previous experimental and theoretical results on interference effects in small-angle elastic scattering of intermediate-energy polarized protons. Using the Born approximation with suitable approximations a prediction for the left-right asymmetry is obtained without free parameters, which indicates the energy and angular range where large effects due to Coulomb interaction can be found. The possiblity of further experimental investigations is also discussed. (L.B.S.)

**44742** WAVE FUNCTIONS OF SPHERICAL ODD-MASS NUCLEI. **Prosperi, D.; Salusti, E. (Univ., Rome. CNEN, Casaccia, Italy. Laboratoire Joliot Curie de Physique Nucleaire, Orsay, France). Nuovo Cimento (10), 44B: 233-52(Aug. 11, 1966).**

A procedure presented previously was generalized in order to describe collective properties of odd-mass nuclei. The problem was considered first in the general case of fermions interacting by realistic two-body forces. The present classification of low lying states of odd nuclei was confirmed. The lowest states can be separated in two groups: one-quasi-particle and phonon-particle states. From the general case a schematic model grounded on (pairing + $P^{(2)}$) forces was derived and applied to $^{205}$Pb, in order to study the general features of wave functions. (auth)

**44743** FLUCTUATIONS IN TOTAL NEUTRON CROSS SECTIONS OF Na, Al, Si, P, S IN THE ENERGY INTERVAL FROM 5.0 TO 8.5 Mev. **Fasoli, U. (Univ., Padua. Istituto Nazionale di Fisica Nucleare, Padua); Toniolo, D.; Zago, G.; Fabiani, F. Nuovo Cimento (10), 44B: 455-9 (Aug. 11, 1966).**

The results of some measurements of the neutron total cross sections of Al, P, Si, Na, and S in the energy range from 5.0 to 8.5 Mev are presented, together with the results of a preliminary analysis of the data. (D.C.W.)

**44744** ISOTOPIC-SPIN SELECTION RULES AND MECHANISM OF REACTIONS INVOLVING VIRTUAL PHOTONS IN LIGHT NUCLEI. Bosco, B. (Univ., Turin. Univ., Cagliari, Italy. Ecole Normale Superieure, Orsay, France); Carazza, B.; Delsanto, P. P. Nuovo Cimento (10), 44B: 464-8(Aug. 11, 1966).

It is shown that the mechanisms of reactions in light nuclei can be established and the validity of the selection rules governing these processes can be tested by the appropriate use of vertical photons. The reaction $e + {}^6Li \rightarrow e' + {}^4He + d$ is considered in detail. (D.C.W.)

**44745** FINITE RANGE OF DATA ERRORS AFFECTING THE ANALYSIS OF A FLUCTUATING EXCITATION FUNCTION. Gadioli, E. (Univ., Milan. Istituto Nazionale di Fisica Nucleare, Milan); Iori, I.; Sansoni, M. Nuovo Cimento (10), 45B: 56-9(Sept. 11, 1966).

The finite range of data (FRD) errors that affect the results of analyses of excitation functions fluctuating around a constant average value are studied. Formulas for the bias and the FRD error affecting the value for $\epsilon = 0$ of the relative auto-correlation function in the case of purely statistical reactions are given. For the absolute auto-correlation function, the expressions for the bias and the FRD error, affecting its value for $\epsilon = 0$, both in the case of a pure statistical reaction and in the case of a non-statistical contribution are presented. The bias and the error of the coherence energy are also calculated. (D.C.W.)

**44746** 14 Mev NEUTRON STUDIES ON CHLORINE. Bonazzola, G. C. (Univ., Turin. Istituto Nazionale di Fisica Nucleare, Turin); Chiavassa, E.; Bressani, T. Nuovo Cimento (10), 45B: 60-2(Sept. 11, 1966).

Angular distributions for the elastic and inelastic scattering of 14.2-Mev neutrons by natural Cl were measured. The data for elastic scattering were fitted by an optical-model calculation. The optical-model parameters were used to calculate the reaction cross section; the compound elastic cross section was also estimated. Evidence of the excitation of 5.9-, 6.5-, and 6.9-Mev levels of Cl isotopes was obtained. (D.C.W.)

**44747** OBSERVATION OF ${}^8$He AMONG "HAMMER TRACKS" IN NUCLEAR EMULSION. Deka, G. C.; Deka, K. C.; Pathak, K. (Cotton Coll., Gauhati, India). Nuovo Cimento (10), 45B: 63-5(Sept. 11, 1966).

An attempt was made to establish the existence of ${}^8$He by studying the formation of hammer tracks in G5 emulsions exposed to 3.5-Bev/c mesons($\pi^-$). Decay electron pairs associated with the hammer tracks were detected. Seven of a total of 348 hammer tracks observed were attributed to the decay of ${}^8$He nuclei. (D.C.W.)

**44748** A NOTE ON $d(p,\gamma){}^3He$ AND $d(n,\gamma){}^3H$ REACTIONS. Erdas, F.; Milani, C.; Pompei, A.; Seatzu, S. (Univ., Cagliari, Italy). Nuovo Cimento (10), 45B: 72-5(Sept. 11, 1966).

Some corrections to calculations of radiative deuteron capture by deuterons through magnetic dipole transitions for elastic unitarity and the nonsymmetric state of the three-body ground-state wave function are outlined. (D.C.W.)

**44749** SHELL-MODEL STATES OF THE OXYGEN ISOTOPES. Armigliato, A. (Istituto Nazionale di Fisica Nucleare, Padua); Brandolini, F.; Pellegrini, F.; Crescenti, E. Nuovo Cimento (10), 45B: 92-4(Sept. 11, 1966).

The eight independent two-body matrix elements for the neutron configuration $(1d_{5/2},2s_{1/2})^n$ were redetermined by a least squares fit to observed level energies in the oxygen isotopes. The calculated energy-level diagrams were compared with experimental observations, and calculated relative reduced widths were compared with those observed in the ${}^{17}O(d,p){}^{18}O$ and ${}^{18}O(d,p){}^{19}O$ stripping reactions. (D.C.W.)

**44750** ELASTIC SCATTERING OF POLARIZED DEUTERONS FROM ${}^4$He BETWEEN 18 AND 22 Mev. Arvieux, J.; Darriulat, P.; Garreta, D.; Papineau, A.; Tarrats, A.; Testoni, J. (CEN, Saclay, France). Phys. Lett., 22: 439-41(Sept. 1, 1966).

Angular distributions of polarized deuterons scattered from ${}^4$He were measured for 17.7-, 19.7-, and 21.4-Mev incident energy. Vector and tensor polarization parameters are presented. (auth)

**44751** ON THE ENERGIES OF THE OCTUPOLE STATES OF EVEN-EVEN NUCLEI IN THE ENERGY REGION $228 \leq A \leq 254$. Malov, L. A.; Soloviev, V. G.; Vogel, P. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Lett., 22: 441-2(Sept. 1, 1966).

More accurate calculations of the energies of octupole states of even nuclei in the region $228 \leq A \leq 254$ are given. (auth)

**44752** MAGNETIC MOMENT OF THE FIRST EXCITED STATE IN ${}^{171}$Yb. Gunther, C.; Kankeleit, E. (California Inst. of Tech., Pasadena). Phys. Lett., 22: 443-6(Sept. 1, 1966).

Using Mössbauer techniques, the magnetic moment of the $3/2^-$ rotational state in ${}^{171}$Yb ($\mu = 0.351 \pm 0.003$) and the E2/M1 mixing ratio for the ground-state transition ($\delta^2 = 0.45 \pm 0.03$) were determined. The magnetic properties of the $K = 1/2$ ground state rotational band of ${}^{171}$Yb are discussed in terms of the Nilsson model. (auth)

**44753** MAGNETIC PROPERTIES OF THE $K = 1/2$ ROTATIONAL BAND OF ${}^{171}$Yb. Henning, W.; Kienle, P.; Steichele, E.; Wagner, F. (Technische Hochschule, Munich. Technische Hochschule, Darmstadt, Ger.). Phys. Lett., 22: 446-8(Sept. 1, 1966).

The magnetic moment $\mu_e$ and the mean life $\tau$ of the 66.7-kev state of ${}^{171}$Yb, the E2/M1 mixing ratio $\delta^2$, and the relative E2–M1 phase cos $\varphi$ of the $\gamma$ rays were determined. The magnetic parameters $g_K$, $b_0$, and $g_R$ were deduced and were compared with theory. (auth)

**44754** THE LOW-LYING $J = 1/2$ STATES IN ${}^{21}$Ne AND ${}^{23}$Na. Pelte, D. (Univ., Heidelberg). Phys. Lett., 22: 448-50(Sept. 1, 1966).

A correct description of the low-lying $J^\pi = 1/2^+$ states in ${}^{21}$Ne and ${}^{23}$Na in terms of Nilsson wave functions is given and is applied to the M1 transition probabilities. (auth)

**44755** SOME OBSERVATIONS CONCERNING THE SUPERMULTIPLET OF NEGATIVE-PARITY EXCITED STATES IN THE $\alpha$ PARTICLE. Barrett, B. R.; Walecka, J. D. (Stanford Univ., Calif.). Phys. Lett., 22: 450-4 (Sept. 1, 1966).

Seven theoretical equations for the supermultiplet of negative-parity excited states of ${}^4$He can be expressed in terms of four parameters. Using four empirically determined energy splittings the following quantities can be predicted: the $0^-$ and $1^-$, $T = 0$ states lie near 22- and 28-Mev excitation energy respectively; the ratio of gamma-decay widths of the $1^-, T = 1$ states at 30 and 26 Mev is approximately 0.4. These predictions are compared with experimental evidence. (auth)

**44756** THREE $L = 0$ TRANSITIONS IN THE ${}^{57}Fe(p,t){}^{55}Fe$ REACTION. Maxwell, J. R.; Reynolds, G. M.; Hintz, N. M. (Univ. of Minnesota, Minneapolis). Phys. Lett., 22: 454-6(Sept. 1, 1966).

Three $L = 0$ transitions were observed in the (p,t) reaction on ${}^{57}$Fe, corresponding to $1/2^-$ states in ${}^{55}$Fe at 0.41, 1.98, and 3.77 Mev. An interpretation of the relative strengths is given. (auth)

**44757** DIFFRACTION MODEL INTERPRETATION OF HEAVY-ION INDUCED TRANSFER REACTIONS. Bock, R.; Grosse-Schulte, M.; Von Oertzen, W. (Max Planck Institut fuer Kernphysik, Heidelberg). Phys. Lett., 22: 456-8(Sept. 1, 1966).

Angular distributions for proton and $\alpha$-particle transfer in the reaction ${}^{11}B({}^{16}O,{}^{15}N){}^{12}C$ were measured for transitions to the ground state and the 6.33-Mev level of ${}^{15}$N at E(${}^{16}$O) = 27, 30, 32.5, and 35 Mev. The ground-state angular distribution shows strong and regular oscillations which can be well described by the diffraction model. The appearance of the diffraction structure giving information on (about) the transferred angular momentum can be explained by angular-momentum matching considerations. (auth)

**44758** THE T = 2 ISOBARIC MULTIPLET AT MASS 24. Kingston, F. G. (London Univ.); Griffiths, R. J.; Johnston, A. R.; Gibson, W. R.; McClatchie, E. A. Phys. Lett., 22: 458-60(Sept. 1, 1966).

The reaction $^{26}$Mg(p,$^{3}$He)$^{24}$Na was investigated at $E_p$ = 50 Mev. Isobaric analogue states with T = 2 were identified, and angular distributions identifies the L = 0 character of the interactions. The mass 24, T = 2 quintet is considered in the context of the charge independence of nuclear forces. (auth)

**44759** DECAY OF $^{34}$Ar. Miller, R. G.; Kavanagh, R. W. (California Inst. of Tech., Pasadena). Phys. Lett., 22: 461-3(Sept. 1, 1966).

The mass excess and half life of $^{34}$Ar were measured to be −18394 ± 15 kev and 1.2 ± 0.3 sec. Decay proceeds to the ground (log ft $\gtrsim$ 3.60) and 0.67-Mev (3.31 $\lesssim$ log ft < 5.16) states of $^{34}$Cl. $J^{\pi} = 1^{+}$ is determined for the state at 0.67 Mev. (auth)

**44760** THE EFFECT OF STRONG CORRELATIONS ON BARYON-BARYON WEAK INTERACTIONS. Adams, J. Barclay (Stanford Univ., Calif.). Phys. Lett., 22: 463-6(Sept. 1, 1966).

In models of baryon-baryon weak interactions the introduction of inter-baryon correlations has important effects: accounting for nonmesonic hypernuclear decays by Karplus-Ruderman terms alone, and indicating nuclear parity violation has been overestimated by a factor of 2. (auth)

**44761** SPECTROSCOPIC FACTORS OF ISOBARIC ANALOGUE STATES FROM PROTON EXCITATION OF SOME MEDIUM-WEIGHT EVEN NUCLEI. Gaarde, C.; Wilhjelm, P.; Joergensen, P. Bruun (Univ., Copenhagen). Phys. Lett., 22: 466-9(Sept. 1, 1966).

Analog states were identified as resonances in (p,p) and (p,p′) reactions on Ca, Ni, Zn, and Ge isotopes. The proton widths $\Gamma_p$ relative to single-particle widths calculated from a real Saxon-Woods potential are compared with (d,p) results. (auth)

**44762** NUCLEAR ENERGY LEVELS OF CALCIUM ISOTOPES. Federman, P.; Talmi, I. (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Lett., 22: 469-72 (Sept. 1, 1966).

Nuclear energy levels of $^{42}$Ca through $^{50}$Ca are calculated with effective interactions in the shell model. Configurations with $1f\frac{7}{2}$ and $2p\frac{3}{2}$ neutrons are considered. The $^{42}$Ca deformed states are also included. Good agreement between calculated and experimental energies is obtained. (auth)

**44763** BARRIER PENETRABILITIES AND THE ALPHA-NUCLEUS POTENTIAL. Bencze, Gy.; Sandulescu, A. (Univ., Helsinki). Phys. Lett., 22: 473-4(Sept. 1, 1966).

Arguments are given that the discrepancy in the absolute value of the theoretical alpha-decay rates can be explained by using the correct alpha-nucleus potential and accurate methods for calculating the barrier penetrabilities. (auth)

**44764** ANOMALY OF SMALL ANGLE NEUTRON SCATTERING BY $^{238}$U. Adam, A.; Hrasko, P.; Palla, Gabriella (Central Research Inst. for Physics, Budapest). Phys. Lett., 22: 475-6(Sept. 1, 1966).

Recently it was suggested that an induced fission phenomenon may be responsible for the anomalous small-angle elastic scattering on $^{238}$U. Experiments were made which indicate that direct processes of the type (n,fn′) with an n′ angular distribution peaked at small angles probably do not exist at least for 14.7-Mev neutrons. (auth)

**44765** A LOW-LYING SPIN 1 STATE IN $^{46}$Ti. Lewis, C. W.; Mo, J. N.; Monahan, C. F.; Thomas, M. F.; Twin, P. J. (Univ. of Liverpool). Phys. Lett., 22: 476-7 (Sept. 1, 1966).

Investigation of the 3.17-Mev level in $^{46}$Ti yielded an assignment of spin 1 and, for the transition to the first excited state, a quadrupole-dipole mixing ratio of 0.6. (auth)

**44766** RANDOM-PHASE APPROXIMATION GROUND STATE IN AGREEMENT WITH THE CONSERVATION LAWS. Da Providencia, J. (Univ., Coimbra). Phys. Lett., 22: 478-9(Sept. 1, 1966).

By generalization of a previous argument, it is shown how the random-phase approximation ground state, defined as the state with zero momentum and angular momentum, and without any phonons can be constructed. (auth)

**44767** MUON CAPTURE IN $^{16}$O AND THE POSSIBLE EXISTENCE OF THE INDUCED TENSOR INTERACTION. Ohtsubo, H. (Tokyo Inst. of Tech.). Phys. Lett., 22: 480-2(Sept. 1, 1966).

Analysis of the partial transition rates of muon capture in $^{16}$O into three low-lying levels in $^{16}$N supports the existence of the irregular G-parity interaction. (auth)

**44768** EVIDENCE FOR AN INTERMEDIATE RESONANCE IN $^{26}$Al. Levi, C.; Mermaz, M.; Papineau, L. (CEN, Saclay, France). Phys. Lett., 22: 483-4(Sept. 1, 1966).

Excitation functions for several $\alpha$-particle groups of the reaction $^{24}$Mg(d,$\alpha$)$^{22}$Na were measured for $E_d$ = 4.5 to 10 Mev. There is evidence for intermediate structure in the reaction channel leading to the third excited state of $^{22}$Na. The angular distribution of a broad resonance at 15.9 Mev in $^{26}$Al was obtained. (auth)

**44769** INELASTIC ELECTRON SCATTERING FROM $^{16}$O AND THE RADIATIVE WIDTHS OF THE 6.9 AND 11.5 Mev LEVELS. Stroetzel, M.; Gudden, F. (Technische Hochschule, Darmstadt, Ger.). Phys. Lett., 22: 485-7 (Sept. 1, 1966).

Levels in $^{16}$O between 5- and 14-Mev excitation energy were studied by inelastic electron scattering. Ground-state radiative widths for the $2^{+}$ levels at 6.9 and 11.5 Mev are 0.100 ± 0.015 and 0.52 ± 0.13 ev, respectively. Upper limits for some other transitions are given. The transition radius of the 6.9 Mev level is 3.82 ± 0.46 fm. (auth)

**44770** $^{8}$He PRODUCTION IN NEGATIVE PION CAPTURE BY CARBON AND OXYGEN NUCLEI. Batusov, Yu. A.; Bunyatov, S. A.; Sidorov, V. M.; Yarba, V. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Lett., 22: 487-9(Sept. 1, 1966).

The events of $^{8}$He production and decay in negative pion capture by carbon and oxygen were detected in photo-emulsion. The probability of $^{8}$He production is $(2-3) \times 10^{-6}$. The mass of $^{8}$He was measured to be 7481.3 ± 0.9 Mev. (auth)

**44771** ELASTIC ELECTRON SCATTERING FROM LEAD AND BISMUTH AT 53 Mev. Van Niftrik, G. J. C. (Instituut voor Kernphysisch Onderzoek, Amsterdam); Engfer, R. Phys. Lett., 22: 490-2(Sept. 1, 1966).

Cross sections for the elastic scattering of 52.9-Mev electrons from natural lead and bismuth were measured relative to beryllium. A partial-wave analysis of the data was carried out for a static Fermi-type nuclear charge distribution. (auth)

**44772** SPECTROSCOPY OF $^{208}$Pb BY INELASTIC SCATTERING OF PROTONS AT 24.55 Mev. Saudinos, J.; Vallois, G.; Beer, O.; Gendrot, M.; Lopato, P. (CEN, Saclay, France). Phys. Lett., 22: 492-4(Sept. 1, 1966). (In French).

Inelastic proton scattering by $^{208}$Pb shows a $2^{+}$, $4^{+}$, $6^{+}$, $8^{+}$ level sequence in this nucleus. Some unnatural parity levels are also analyzed. (auth)

**44773** GENERAL COMMENT CONCERNING THE J DEPENDENCE OF DIRECT REACTION CROSS SECTIONS. Henley, E. M. (Univ. of Washington, Seattle); Kelley, T. G. Phys. Lett., 22: 495-8(Sept. 1, 1966). (RLO-1388B-11).

The J-dependence of the differential cross section for direct nuclear rearrangement collisions is discussed for the case in which the spin-orbit distortions can be treated to first order. Experimental predictions are made. (auth)

**44774** CLOSED SHELLS FOR Z > 82 AND N > 126 IN A DIFFUSE POTENTIAL WELL. Sobiczewski, A.;

Gareev, F. A.; Kalinkin, B. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Lett., 22: 500-2(Sept. 1, 1966).

Proton and neutron single-particle levels in a Woods-Saxon potential well with a spin-orbit term are calculated for $Z \geq 82$ and $N \geq 126$ as functions of the mass number A. The possible magic numbers are found to be $Z = 114$ and $N = 184$. (auth)

**44775** NON-EXISTENCE OF THE 5.51 Mev AND 6.10 Mev LEVELS IN $^{13}$C. Christensen, P. R.; Cocke, C. L. (California Inst. of Tech., Pasadena). Phys. Lett., 22: 503-5(Sept. 1, 1966).

Levels at 5.51 Mev and 6.10 Mev in $^{13}$C were previously reported in the reaction $^{11}$B($^{3}$He,p)$^{13}$C at E($^{3}$He) = 1.23 Mev. The corresponding proton groups were found to come from the proton decay of the 9.48-Mev and 10.37-Mev states in $^{13}$N, formed by $^{11}$B($^{3}$He,n)$^{13}$N, rather than from states in $^{13}$C. (auth)

**44776** A TRANSITION BETWEEN ROTATIONAL BANDS IN $^{16}$O. Gorodetzky, S.; Adloff, J.; Chevallier, P.; Disdier, D.; Gorodetzky, Ph.; Modjtahed-Zadeh, R.; Scheibling, F. (Institut de Recherches Nucleaires, Strasbourg). Phys. Lett., 22: 505-6(Sept. 1, 1966). (In French).

The branching ratio for the transitions 11.52 → 6.06 Mev and 11.52 → 0 Mev in $^{16}$O was measured. On the basis of the result, the value $B(E2) = 7.6 \pm 1.7\ e^2 fm^4$ was attributed to the reduced transition probability for the 11.52–6.06 Mev transition. (D.C.W.)

**44777** NUCLEON WIDTHS OF ISOBARIC ANALOGUE STATES IN NUCLEI. Balashov, V. V.; Yadrovskii, E. L. (Moscow State Univ.). Phys. Lett., 22: 507-9(Sept. 1, 1966).

The widths of the $2^-$ analogue states in $^{90}$Zr are calculated. These states are analyzed in terms of their isospin components. (auth)

**44778** ON ($\gamma$,p) AND ($\gamma$,n) REACTIONS MECHANISM IN THE MEDIUM AND HEAVY NUCLEI REGION. Balashov, V. V.; Yadrovskii, E. L. (Moscow State Univ.). Phys. Lett., 22: 509-10(Sept. 1, 1966).

Coupling in additional configurations necessary to obtain levels of good isospin pushes the ($\gamma$,p) cross section to higher energies than the ($\gamma$,n) cross section. (auth)

**44779** HARTREE-FOCK TYPE CALCULATION OF $^{12}$C. Bouten, M.; Schotsmans, L.; Van Leuven, P. (Studiecentrum voor Kernenergie, Mol, Belgium). Phys. Lett., 22: 510-11(Sept. 1, 1966).

A variational calculation using a projected Slater determinant shows that the admixture of 0d and 0f oscillator states is very important for the ground state of $^{12}$C. These admixtures increase the binding energy by 10 Mev. (auth)

**44780** NEUTRON SPIN ASYMMETRY FROM SPIN-ORBIT SCATTERING NEAR A THERMAL ABSORPTION RESONANCE. Obermair, G. (Technische Hochschule, Munich). Phys. Lett., 22: 573-4(Sept. 15, 1966).

The interference of spin-orbit scattering of neutrons and nuclear scattering at an absorption resonance is considered. From the observed neutron spin asymmetry one can determine the resonance parameters or the spin-orbit scattering amplitude. (auth)

**44781** NOTE ON PARITY AND THE ASYMMETRIC TOP MODEL. Davidson, M. G. (Australian National Univ., Canberra). Phys. Lett., 22: 596-7(Sept. 15, 1966).

A method of showing the parity of an eigenfunction of the asymmetric top Hamiltonian is developed, and its application to deformed even nuclei is discussed. (auth)

**44782** COLLECTIVE STATES OF $^{107}$Ag. Black, J. L.; Gruhle, W.; Heikkinen, D. W. (Stanford Univ., Calif.). Phys. Lett., 22: 598-601(Sept. 15, 1966).

A high-resolution study of the $\gamma$ spectra following $\beta$ decay and Coulomb excitation has led to a revised level scheme for $^{107}$Ag. Some states can be interpreted as arising from the coupling of an odd proton with vibrational core states. (auth)

**44783** THE $\frac{3}{2}^{-} \rightarrow \frac{1}{2}^{-}$ MIRROR TRANSITIONS IN MASS 15. Rose, H. J.; Lopes, J. S. (Oxford Univ.). Phys. Lett., 22: 601-3(Sept. 15, 1966).

An error in the calculation of the sign of the E2/M1 mixing ratio of the $\frac{3}{2}^{-} \rightarrow \frac{1}{2}^{-}$, 6.33 Mev transition in $^{15}$N is corrected. It is shown that a weak coupling treatment cannot yield the required effective charge parameters to describe the mixing ratios of the $\frac{3}{2}^{-} \rightarrow \frac{1}{2}^{-}$ mirror transitions in mass 15. (auth)

**44784** COMPARISON OF SIGNS OF MIXING RATIOS TO MODEL PREDICTIONS. Haeusser, O.; Rose, H. J.; Lopes, J. S.; Gill, R. D. (Oxford Univ.). Phys. Lett., 22: 604-6(Sept. 15, 1966).

Mixing ratios for transitions in $^{18}$F, $^{16}$O, $^{15}$N, and $^{14}$N were calculated in the framework of the shell model and were compared to experimental values. The conventions of Rose and Brink were used to calculate the theoretical quantities and to extract the experimental quantities. (auth)

**44785** HARTREE-FOCK CALCULATIONS WITH A DENSITY-DEPENDENT INTERACTION. Krieger, S. J. (Carnegie Inst. of Tech., Pittsburgh); Baranger, M.; Davies, K. T. R. Contract Nonr 760(15) NR 024-439. Phys. Lett., 22: 607-10(Sept. 15, 1966).

A simple, density-dependent, effective two-nucleon interaction is used in the calculation of finite nuclei by the Hartree-Fock approximation. Results are obtained for the binding energy, density, and single-particle levels of $^{12}$C, $^{16}$O, $^{28}$Si, and $^{40}$Ca. (auth)

**44786** A SEARCH FOR THE $^{3}$He(p,n)3p REACTION. Cookson, J. A. (Atomic Weapons Research Establishment, Aldermaston, Eng.). Phys. Lett., 22: 612-13 (Sept. 15, 1966).

A measurement of neutrons from the reaction $^{3}$He(p,n)3p with 13.1-Mev incident protons gave a cross section of 5 $\mu$b with an uncertainty of 18 $\mu$b. The cross section is much lower than either the theoretical prediction or the measured value for the charge symmetric reaction T(n,p)3n. (auth)

**44787** STRUCTURE OF THE FIRST THREE EXCITED STATES IN $^{208}$Pb. Moore, C. F. (Univ. of Texas, Austin); Parish, L. J.; Von Brentano, P.; Zaidi, S. A. A. Phys. Lett., 22: 616-18(Sept. 15, 1966).

The nuclear structure of the first three excited states in $^{208}$Pb was studied using inelastic proton scattering on $^{208}$Pb at proton energies corresponding to isobaric analogue resonances in $^{209}$Bi. (auth)

**44788** SEMIMICROSCOPIC DESCRIPTION OF EVEN Hg SPECTRA. Alaga, G.; Ialongo, G. (Univ. of California, Berkeley. Institut de Physique Nucleaire, Orsay, France. New York Univ., New York). Contract W-7405-eng-48. Phys. Lett., 22: 619-22(Sept. 15, 1966).

A qualitative description of the properties of the low lying states of the even even nuclei around lead and tin isotopes is proposed in terms of protons (holes) coupled to a harmonic vibrator. (auth)

**44789** NUCLEAR CHARGE RADIUS DIFFERENCE FOR $^{46}$Ti–$^{50}$Ti. Theissen, H. (Technische Hochschule, Darmstadt, Ger.); Engfer, R.; Van Niftrik, G. J. C. Phys. Lett., 22: 623-4(Sept. 15, 1966).

The change in nuclear rms radii $R_m$ for $^{46}$Ti–$^{50}$Ti was measured by electron scattering at 29 and 58 Mev, analyzed for static charge distributions. The result is $\Delta R_m/R_m = 0.0 \pm 0.4\%$ if the skin thickness t of the charge distribution is the same for both nuclides, and $0.0 \pm 1.2\%$ if $\Delta t \leq \pm 10\%$. (auth)

**44790** LOWEST $T = \frac{3}{2}$ STATE IN $^{29}$P. Youngblood, D. H.; Morrison, G. C.; Segel, R. E. (Argonne National Lab., Ill.). Phys. Lett., 22: 625-6(Sept. 15, 1966).

The residual activity between bursts of a mechanically chopped beam was used to measure the $^{28}$Si(p,$\gamma$)$^{29}$P yield near the lowest $T = {}^3/_2$ state. This resonance was found at $E_p = 5.833 \pm 0.010$ Mev and has $\Gamma_{total} = 2.5$ kev and $\Gamma_\gamma = 0.8 \pm 0.3$ ev. (auth)

**44791** DETERMINATION OF THE GYROMAGNETIC RATIOS OF SOME ODD-A DEFORMED NUCLEI FROM BRANCHING RATIO MEASUREMENTS. Boehm, F.; Goldring, G.; Hagemann, G. B.; Symons, G. D.; Tveter, A. (Univ., Copenhagen). Phys. Lett., 22: 627-9(Sept. 15, 1966).

The branching ratios for the gamma decay of the lowest three or four states in the ground-state rotational bands of the odd-A nuclei $^{153}$Eu, $^{155}$Gd, $^{157}$Gd, $^{159}$Tb, $^{161}$Dy, $^{163}$Dy, $^{165}$Ho, $^{167}$Er, $^{169}$Tm, $^{171}$Yb, $^{173}$Yb, $^{175}$Lu, and $^{181}$Ta were measured following Coulomb excitation with ~45 Mev $^{16}$O ions. These ratios are found to be consistent with the predictions of the rotational model. Values of the gyromagnetic ratios $g_K$ and $g_R$ were derived from these measurements and are compared to recent theoretical calculations by Nilsson and by Prior. (auth)

**44792** CORE EXCITATION OF $^{20}$Ne. Borse, G. J.; Eisenberg, J. M. (Univ. of Virginia, Charlottesville). Phys. Lett., 22: 630-1(Sept. 15, 1966).

Odd parity states of $^{20}$Ne arising from excitation of the $^{16}$O core are studied using the SU(3) classification scheme. A $K = 0$, $L = 0^-, 2^-, 4^-, \ldots$ band is predicted to begin at about 10 Mev. The E2 transitions between such states are discussed. (auth)

**44793** TEST OF TIME-REVERSAL INVARIANCE IN THE REACTIONS $^{24}$Mg($\alpha$,p)$^{27}$Al AND $^{27}$Al(p,$\alpha$)$^{24}$Mg. Von Witsch, W.; Richter, A.; Von Brentano, P. (Max-Planck-Institut fuer Kernphysik, Heidelberg). Phys. Lett., 22: 631-3(Sept. 15, 1966).

As a test of time-reversal invariance, excitation functions of the reactions $^{24}$Mg($\alpha$,p)$^{27}$Al and $^{27}$Al(p,$\alpha$)$^{24}$Mg were measured in the energy region where the cross section fluctuates strongly. The two curves agree within the errors. (auth)

**44794** COMPARISON OF (d,t) AND (d,$^3$He) CROSS SECTIONS. Detraz, C. (Institut de Physique Nucleaire, Orsay, France); Gaillard, M.; Bouche, R.; Feuvrais, L.; Gaillard, P.; Gouanere, M.; Gusakow, M.; Pizzi, J. R. Phys. Lett., 22: 638-9(Sept. 15, 1966).

The (d,t) and (d,$^3$He) cross sections, which are equal with $^{12}$C and $^{14}$N targets, are strongly different for $^{40}$Ca. Tentative explanations of this effect are presented. (auth)

**44795** SECOND-ORDER EXCITATION IN THE INELASTIC SCATTERING OF $\alpha$ PARTICLES. Bruge, G.; (Centre d'Etudes Nucleaires, Saclay, France); Faivre, J. C.; Faraggi, H.; Vallois, G.; Bussiere, A.; Roussel, P. Phys. Lett., 22: 640-2(Sept. 15, 1966). (In French).

Two-phonon excitations observed in the inelastic scattering of $\alpha$ particles were analyzed for $^{52}$Cr, $^{54}$Fe, $^{56}$Fe, $^{58}$Fe, $^{58}$Ni, $^{60}$Ni, $^{62}$Ni, $^{64}$Ni, $^{46}$Ti, $^{48}$Ti, and $^{50}$Ti using the Austern-Blair model. The experimental data are not always in agreement with a two-phonon description of these levels. (S.F.L.)

**44796** ANALOGUE STATE RESONANCES IN THE (p,p$_0$) AND (p,p') PROCESSES. Tamura, T. (Oak Ridge National Lab., Tenn.). Phys. Lett., 22: 644-8(Sept. 15, 1966).

Analogue-state resonances in the (p,p$_0$) and (p,p') processes are analyzed in terms of extended coupled-channel calculations. The way to extract the spectroscopic factors is also discussed. (auth)

**44797** TEST OF THE MICROSCOPIC THEORY OF THE NUCLEAR GAMMA VIBRATION. Shelton, W. N.; Watson, C. E. (Florida State Univ., Tallahassee). Phys. Lett., 22: 648-50(Sept. 15, 1966).

Experimental determinations of the relative (d,p) cross sections of the gamma vibrations in several even spheroidal nuclei were made. These results are compared to a theoretical calculation based on a microscopic description of the gamma vibrations in terms of $2^+$ two-quasi-particle states. (auth)

**44798** SINGLE-PARTICLE WIDTHS IN $^{207}$Pb(pp) AND (pp') FOR THE ISOBARIC ANALOGUE STATE OF THE GROUND STATE OF $^{208}$Pb. Andersen, B. L.; Bondorf, J. P.; Madsen, B. S. (Niels Bohr Institutet, Copenhagen). Phys. Lett., 22: 651-4(Sept. 15, 1966).

Partial proton widths of the isobaric analogue state of the ground state of $^{208}$Pb are calculated assuming the states of $^{207}$Pb to be neutron-hole states. A comparison is made with experimental widths obtained from the scattering of protons by $^{207}$Pb. (auth)

**44799** QUADRUPOLE AND OCTUPOLE EXCITATIONS OF SPHERICAL EVEN-EVEN NUCLEI IN THE REGION OF CLOSED SHELLS. Bruge, G. (Centre d'Etudes Nucleaires, Saclay, France); Faivre, J. C.; Faraggi, H.; Vallois, G.; Bussiere, A.; Rousel, P. Phys. Lett., 22: 654-6 (Sept. 15, 1966). (In French).

Experimental results obtained at Saclay by alpha-particle scattering on even-even spherical nuclei were analyzed using the Austern-Blair model. Deformation parameters $\delta_l^2$ and transition probabilities B(I → 0) are compared with other experimental data and theoretical predictions. (auth)

**44800** DISTORTED WAVE PREDICTIONS OF OBSERVED J DEPENDENCE IN THE (d,$^3$He) REACTION. Preedom, B. M. (Oak Ridge National Lab., Tenn.); Newman, E.; Hiebert, J. C. Phys. Lett., 22: 657-9(Sept. 15, 1966).

The J dependence of the $l = 1$ proton transfers for the $^{90}$Zr(d,$^3$He)$^{89}$Y reaction was observed at 34.4 Mev. With the inclusion of a spin-orbit interaction in the deuteron channel, distorted-wave calculations quantitatively predict this effect. (auth)

**44801** SPECTROSCOPY OF $^{207}$Pb BY INELASTIC SCATTERING OF 24.5-Mev PROTONS. Vallois, G.; Saudinos, J.; Beer, O.; Gendrot, M.; Lopato, P. (Centre d'Etudes Nucleaires, Saclay, France). Phys. Lett., 22: 659-61(Sept. 15, 1966). (In French).

The splitting of the $3^-$, $2^+$, and $6^+$ collective levels in $^{208}$Pb was observed in $^{207}$Pb by inelastic proton scattering at $E_p = 24.5$ Mev. Other levels were analyzed. (auth)

**44802** LONG-RANGE PERTURBATIONS OF BOUND STATES AND RESONANCES. Noble, Julian V. (Princeton Univ., N. J.). Phys. Rev., 148: 1528-36(Aug. 26, 1966).

The modification of the scattering matrix in multichannel potential-scattering theory by a long-range perturbation is considered. The perturbation of single-particle energy levels (bound states or resonances) is discussed by means of Weinberg's eigenvalue analysis of potential scattering. A straightforward distinction between single-particle and compound states appears in this formalism, and it leads to a proof that there are no bound states embedded in the continuum. A simple approximation for the eigenvalues corresponding to single-particle levels is developed and is applied to the calculation of the energy difference between the $({}^1/_2{}^+)$ first excited states of the $^{13}$C−$^{13}$N mirror pair. (auth)

**44803** LEPTONIC DECAY OF THE HYPERFRAGMENT $^4_\Lambda$H. McNamee, P.; Oakes, R. J. (Stanford Univ., Calif.). Contract AF49(638)-1389. Phys. Rev., 149: 1157-63 (Sept. 30, 1966).

The leptonic decay of the hyperfragment $^4_\Lambda$H is analyzed. The decay distributions and rates are calculated in impulse approximation for the strangeness-changing $0^+ \rightarrow 0^+$ transition $^4_\Lambda\text{H} \rightarrow {}^4\text{He} + l^- + \bar{\nu}_l$. Numerical results are given assuming Gaussian wave functions for $^4_\Lambda$H and $^4$He and taking the single-particle transition amplitude $\Lambda \rightarrow p + l^- + \bar{\nu}_l$ from the Cabibbo hypothesis. The rates for the decays $^4_\Lambda\text{H} \rightarrow {}^4\text{He} + e^- + \bar{\nu}_e$ and $^4_\Lambda\text{H} \rightarrow {}^4\text{He} + \mu^- + \bar{\nu}_\mu$ are found to be $2.66 \times 10^6$ sec$^{-1}$ and $8.24 \times 10^5$ sec$^{-1}$, respectively. In addition to providing a direct measurement of the strangeness-changing vector coupling constant, these processes can be used to investigate the possible existence of an induced scalar (class II) strangeness-changing interaction. The effect of small admixtures of such an induced scalar interaction were calculated to illustrate this point. Finally, it is shown that large corrections to the $SU_3$-symmetric calculation of the matrix element for ${}^4_\Lambda H \rightarrow {}^4He + e^- + \bar{\nu}_e$ are present because of the mixing of $SU_3$ representations and distortion of the spatial wave functions. (auth)

**44804** MEASUREMENT OF THE SPIN DEPENDENCE OF THE REACTION $^3$He(n,p)T AND OF THE NUCLEAR SUSCEPTIBILITY OF ADSORBED $^3$He. Passell, L.; Schermer, R. I. (Brookhaven National Lab., Upton, N. Y.). Contract AT(30-2)-Gen-16. Phys. Rev., 150: 146-51(Oct. 7, 1966). (BNL–10179).

The spin dependence of the $^3$He(n,p)T reaction was investigated by studying the transmission of polarized thermal neutrons through a polarized $^3$He target which consisted of $^3$He adsorbed on zeolite. It was found that the interaction cross section was essentially all associated with an $I - \frac{1}{2} = 0$ channel, i.e., $\sigma_{I-\frac{1}{2}}/\sigma_0 = 1.010 \pm 0.032$. Once the spin dependence of the cross section was established, polarized neutrons provided a convenient method of studying the nuclear spin susceptibility of $^3$He. Susceptibility measurements were made on our adsorbed-phase target over the temperature range 0.06–1.0°K. It was found that the nuclear susceptibility began to fall below Curie's law at about 0.2°K, indicating the onset of some type of antiparallel ordering in the nuclear spin system. (auth)

**44805** TESTS OF TIME-REVERSAL INVARIANCE IN THE REACTIONS $^{24}Mg + d \rightleftharpoons {}^{25}Mg + p$. Bodansky, D.; Braithwaite, W. J.; Shreve, D. C.; Storm, D. W.; Weitkamp, W. G. (Univ. of Washington, Seattle). Phys. Rev. Lett., 17: 589-92(Sept. 12, 1966).

No evidence for a violation of time-reversal invariance was found in a study of the inverse reactions $^{24}Mg + d \rightleftharpoons {}^{25}Mg + p$, using 10-Mev deuterons and 15-Mev protons. Relative differential cross sections for the two reactions agree to within an experimental standard deviation of 0.4%. This is tentatively interpreted as implying that the ratio of the T-odd to T-even reaction amplitudes is probably less than 0.4%. (auth)

**44806** ROLE OF PERTURBED ANGULAR CORRELATIONS IN SYMMETRY TESTS. Lewis, R. R. Jr. (Univ. of Michigan, Ann Arbor). Phys. Rev. Lett., 17: 593-5 (Sept. 12, 1966).

It is shown that by using the effects of perturbations of the intermediate state in correlation measurements, the need for using polarized particles can be eliminated; and the over-all efficiency of the experiments can be enhanced by a large factor. In particular, the measured parity admixture in $^{181}$Ta is used to predict an asymmetry in the directional correlation of the 133-482 coincidence from a single-crystal Hf source. The application of this approach to testing T invariance, as well as P invariance, is also briefly considered. (D.C.W.)

**44807** PROPERTIES OF PARTIAL RADIATION WIDTHS IN $^{196}$Pt. Jackson, H. E. (Centre d'Etudes Nucleaires, Saclay, France); Julien, J.; Samour, C.; Bloch, A.; Lopata, C.; Morgenstern, J.; Mann, H.; Thomas, G. E. Phys. Rev. Lett., 17: 656-8(Sept. 19, 1966).

The results of a study of resonance capture in $^{195}$Pt that confirms the validity of the Porter-Thomas distribution for partial radiation widths are presented. Information on the energy-level scheme of $^{196}$Pt was also obtained. (D.C.W.)

**44808** PROPERTIES OF THE 3.16-Mev LEVEL OF $^{35}$Cl. Azuma, R. E.; Oleksiuk, L. W.; Prentice, J. D.; Taras, P. (Univ. of Toronto). Phys. Rev. Lett., 17: 659-61(Sept. 19, 1966).

The energy levels of $^{35}$Cl were investigated using the reaction $^{34}S(p,\gamma)^{35}Cl$. The results show that the spin and parity of the 3.16-Mev level of $^{35}$Cl are $J^\pi = \frac{7}{2}^-$ and that the decay of this state proceeds through a mixed E3/M2 transition to the ground state. Evidence that the E1 transition of 1.40 Mev to the $\frac{5}{2}^+$, 1.76-Mev level is extremely inhibited was also obtained. (D.C.W.)

**44809** SEARCH FOR THE TRINEUTRON. Thornton, S. T.; Bair, J. K.; Jones, C. M.; Willard, H. B. (Oak Ridge National Lab., Tenn.). Phys. Rev. Lett., 17: 701-2 (Sept. 26, 1966).

Since the existence of the trineutron would be very important in the understanding of the few-nucleon problem, a search for the trineutron in the reaction $T(n,p)n^3$ with 20.8-Mev neutrons was made. No evidence for the existence of the trineutron was found. (auth)

**44810** STRETCH SCHEME, A MICROSCOPIC DESCRIPTION OF ROTATIONS IN NUCLEI. Danos, M.; Gillet, V. (Centre d'Etudes Nucleaires, Saclay, Gif-sur-Yvette, France. National Bureau of Standards, Washington, D. C.). Phys. Rev. Lett., 17: 703-5(Sept. 26, 1966).

A good angular-momentum wave function containing the maximum possible intrinsic angular momenta leads to rotational spectra. The rotational excitation energies arise from the residual two-body force. (auth)

**44811** MASSES OF $^{12}$N, $^{24}$Al, $^{28}$P, $^{32}$Cl, AND $^{40}$Sc. Bromley, D. A.; Overley, J. C.; Parker, P. D. (Yale Univ., New Haven). Phys. Rev. Lett., 17: 705-8(Sept. 26, 1966).

The masses of $^{24}$Al, $^{32}$Cl, $^{12}$N, $^{28}$P, and $^{40}$Sc were determined by measuring the threshold energies for the reactions $^{24}Mg(p,n)^{24}Al$, $^{32}S(p,n)^{32}Cl$, $^{12}C(p,n)^{12}N$, $^{28}Si(p,n)^{28}P$, and $^{40}Ca(p,n)^{40}Sc$. (D.C.W.)

**44812** QUADRUPOLE MOMENT OF THE FIRST EXCITED STATE OF SPHERICAL NUCLEI. Dang, G. Do (Physique Theorique et Hautes Energies, Orsay, France); Dreizler, R.; Klein, A.; Wu, C. S. Phys. Rev. Lett., 17: 709-12(Sept. 26, 1966).

Two mechanisms are described which can account qualitatively for enhanced static quadrupole moments of the first excited ($2^+$) state of spherical nuclei. The associated calculations indicate the breakdown of the usual approximations based on pairing theory plus random-phase approximation. (auth)

**44813** ASSOCIATED PARTICLE METHOD FOR THE $D(d,n)^3He$ REACTION. Put, L. W.; Bot, C.; Coenders, W. J.; Koene, J. W.; Blok, J. (Vrije Univ., Amsterdam). Physica, 32: 1397-1406(Aug. 1966).

An associated particle method for the $D(d,n)^3He$ reaction is described. To avoid the detection of deuterons elastically scattered from the target by the $^3$He detector, the different deflection of these particles in the field of a cylindrical condenser was utilized. This associated-particle method was used for measurements of angular distributions of $\gamma$ rays from inelastic scattering of 2.5-Mev neutrons by $^{54}$Fe and $^{56}$Fe. (auth)

**44814** OBJECTIVE CRITERION OF THE LIMIT OF USEFUL SOPHISTICATION OF THE SEMI-EMPIRICAL MASS EQUATION. Feather, N. (Univ. of Edinburgh). Proc. Roy. Soc. Edinburgh, A, 47: 104-25(1964-65).

A "roughness parameter", first used in 1953 [N. Feather, Adv. Phys. 2: 141-84(1953)] was recalculated for 348 points on the mass surface. Systematic features are identified in relation to the variation of this parameter with charge number Z and isotopic number D. In the region of small Z these regularities provide evidence for the persistence of some degree of alpha-unit structure at least as far as $^{40}$Ca. In the region of greater Z, ($20 < Z < 50$) they provide evidence for neutron-proton interactions among the last-added nucleons. Overall, they indicate that the "residuals" characterizing the various semi-empircal mass equations currently in use very probably arise in large part from sub-shell effects which would be impractical to attempt to include in the equations. (auth)

**44815** MASS YIELDS OF $^{99}$Mo, $^{105}$Rh AND $^{132}$Te IN THE SPONTANEOUS FISSION OF $^{238}$U. Jadhav, A. V.; Shahani, C. J.; Ramaniah, M. V.; Rao, C. L. (Atomic Energy Establishment, Trombay, India). pp 3-8 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Activities of $^{99}$Mo, $^{105}$Rh, and $^{132}$Te in equilibrium with natural uranium were determined and cumulative yields for the respective mass numbers were calculated on the basis of Segre's value of $8 \times 10^{15}$ yr for the spontaneous fission half life of $^{238}$U. The fission yield of mass number 105 was of particular interest as it extended the light fragment wing of the mass distribution curve toward the trough region. Although fission products were isolated from natural uranium, simple calculations showed that the contribution from neutron-induced fission of $^{235}$U is negligible because of the high neutron absorption cross section of $^{35}$Cl present in $UO_2Cl_2$. (P.C.S.)

**44816** ISOMERIC CROSS-SECTION RATIOS IN THE (n,γ) REACTIONS ON $^{76}$Ge AND $^{82}$Se. Iyer, R. S.; Ramaniah, M. V.; Rao, C. L.; Prakash, Satya (Atomic Energy Establishment, Trombay, India). pp 9-14 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

Isomer ratios in (n,γ) reactions of reactor neutrons with $^{76}$Ge and $^{82}$Se were determined by the activities of $^{77}$As and $^{83}$Br formed by decay of $^{77}$Ge and $^{83}$Se isomers, respectively. Ratios for both $^{77}$Ge and $^{83}$Se isomers agreed with values calculated previously on the basis of statistical and Fermi gas models, but the $^{77}$Ge-value differed considerably from older literature values. Samples of $GeO_2$ and $SeO_2$ wrapped in cadmium were irradiated to study the effect of epicadmium neutrons in the positions used for irradiations. The selenium ratio did not show any appreciable change indicating lack of sensitivity to the neutron spectra; the germanium ratio of epicadmium neutrons could not be determined, owing to the low activities formed after irradiation with the highest neutron flux available. (P.C.S.)

**44817** NUCLEAR SPECTROSCOPIC STUDIES OF THE $^{101}$Mo → $^{101}$Tc → $^{101}$Ru DECAY CHAIN USING CHEMICALLY SEPARATED ACTIVITIES. Rane, A. T.; Hosangdi, R. R.; Devare, H. G. (Tata Inst. of Fundamental Research, Bombay). pp 15-19 of Proceedings of the Nuclear and Radiation Chemistry Symposium, 1966. Bombay, Department of Atomic Energy, 1966.

A method was developed for extraction of Mo activity quantitatively from the daughter-activity ($^{101}$Tc) with the same half life. Beta and gamma spectra of the two activities were studied independently using a solid-state detector and a scintillation spectrometer. The activities were produced by irradiating quantities of enriched $^{100}$Mo (>90) in the Apsara reactor for periods ranging between 10 to 30 minutes. The only interference noted was due to an 845-kev gamma ray, which was attributed to $^{56}$Mn impurity. Chemical separation of $^{101}$Mo was accomplished using RAPOX (Res-acetophenone oxime) in cyclohexanone with about 99% efficiency. Beta and gamma spectra were recorded on a 512 channel analyzer in order that the activities could be studied within one minute of the separation. The beta spectrum from the $^{101}$Mo activity extended to 2330 kev while that of $^{101}$Tc ended at 1350 kev. (P.C.S.)

**44818** QUADRUPLE CORRELATION IN THE EXTRA BINDING ENERGY OF THE s-d SHELL NUCLEI. Suzuki, Kenji; Nagata, Sinobu (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 36: 37-50(July 1966).

The saturation property of the α-type particles which appears in the series of the extra separation energies in the s-d shell nuclei is discussed. To explain this property, the binding energies of 2 ~ 5 particles outside the core $^{16}$O are discussed qualitatively in the j-j and L-S schemes and are calculated with projected variational self-consistent wave function and the SU(3) model, using the reaction matrix as the residual interaction. In these calculations it is shown that the $T = 0$ interaction plays an essential role in the configuration mixing and the saturation property, together with the pairing interaction $V(J = 0, T = 1)$. It is concluded that the saturation property is a consequence of the change of the contribution from the large two-body interaction $V(J = 0, T = 1)$, $V(J = J_{max}, T = 0)$ and $V(J = J_{min}, T = 0)$. Futhermore, the possibility of testing the effective interaction by comparing the results of calculations with the reaction matrix and with a phenomenological effective interaction of the Gaussian type is discussed. (auth)

**44819** COMPUTATION OF PARTIAL AND COMPLETE YIELDS OF FISSION FRAGMENTS. Krisyuk, I. T.; Shpakov, B. I. Radiokhimiya, 7: 692-703(1965). (In Russian).

The fragments produced indicate that in the calculation of partial and complete yields of fission fragments it is necessary to take into consideration a large number of factors which can affect the size of the final activity of the isotopes studied. In the calculation of complete yields it is necessary also to evaluate the corrections to the yield of subsequent members of the chain and noninstantaneous decay of predecessors. By means of the calculation of yields by the formulas derived with account taken of all corrections, values of the yield that are almost accurate can be obtained. The results lay no claim to completeness; they only include basic cases of yield calculation. Formulas for calculation of yields and other cases can be derived by analogy with the present work (tr-auth)

**44820** FROM A LECTURE ON A TABLE OF ISOTOPES. Amerio, Alessandro. Rend. Ist. Lombardo Sci. Lett., A, 95: 589-604(1961). (In Italian).

A table was constructed which categorizes the iosotopes according to half life, γ-emission, and β-emission properties. Various relations among these properties are discussed. (S.F.L.)

**44821** FROM A LECTURE ON A TABLE OF ISOTOPES. SECOND NOTE. THE ENERGIES. Amerio, Alessandro Rend. Ist. Lombardo Sci. Lett. A, 98: 631-44(1964). (In Italian).

The distribution of energies released in the α decay, β decay, and γ emission of isotopes is analyzed in relation to half lives and isotopic masses. A number of general observations are discussed. (S.F.L.)

**44822** THE $^{31}P(p,\gamma)^{32}S$ REACTION IN THE PROTON ENERGY REGION 800-1160 kev. Holmberg, Peter (Univ. of Helsinki). Soc. Sci. Fenn., Comment. Phys.-Math., 31: No. 7, 1-20(1965).

The yield curve for the $^{31}P(p,\gamma)^{32}S$ reaction was investigated in the proton energy region 800–1160 kev. Thirteen resonances were found, five of which had not previously been reported, earlier reports indicating only one resonance at proton energy $E_p = 1147$ kev. In the present investigation, this resonance is split up into two resonances with energies $E_p = 1146$ kev and 1151 kev, respectively. By making use of single and coincidence spectra it was possible to propose the decay modes of seven resonance states. The branching ratios for lower lying levels are also reported. (auth)

**44823** PHOTODISINTEGRATION OF THE $^3$He AND $^3$H NUCLEI. Mamasakhlisov, V. I.; Dzhibuti, R. I.; Macharadze, T. S. (Inst. of Phys., Tbilisi). Soobshch. Akad. Nauk Gruz. SSR, 40: 567-72(1965). (In Russian).

The angular distributions of the nucleons from the reactions $^3He(\gamma,n)2p$ and $^3He(\gamma,p)d$ were determined, as well as the contribution of the quadrupole terms to the reaction cross sections, the energy distribution of the nucleons in 3-particle break-down, and the effect of admixtures of the mixed symmetry state on the wave function for the nucleus. (D.C.W.)

**44824** POLARIZATION OF ANTIMONY, YTTRIUM, AND COPPER NUCLEI IN IRON. Chilashvili, O. A.; Agureev, V. N.; Gorobchenko, V. D.; Samoilov, B. N.; Sklyarevskii, V. V. (State Univ., Tbilisi). Soobshch. Akad. Nauk Gruz. SSR, 40: 581-8(1965). (In Russian).

The internal magnetic fields of Sb, Cu, and Y nuclei in Fe were determined. The sign on Cu nuclei was determined from the asymmetry of $\beta^-$ and $\beta^+$ radiation from polarized $^{64}$Cu nuclei in dilute solutions of Fe. The temperature of the specimen was determined from the temperature dependence of the angular distribution of γ radiation from polarized $^{60}$Co nuclei in Fe. The magnitude of the hyperfine splitting of $^{122}$Sb and $^{90}$Y in Fe was from the asymmetry of the angular distribution of $\beta^+$-e for the first-forbidden transition of $^{122}$Sb and $^{90}$Y nuclei polarized in Fe. The fields on Sb and Y were negative. The internal magnetic fields of both Sb and Y were 205 kOe within 5%. (D.C.W.)

**44825** OCTUPOLE OSCILLATIONS OF EVEN-EVEN DEFORMED NUCLEI WITH SMALL NONAXIALITY. Leper, D. P. Vestn. Akad. Nauk Kaz. SSR, No. 12, 69-71 (Dec. 1965). (In Russian).

Collective excitation states of nuclei described by a phenomenological collective model were considered in two types of approximations; an approximation introducing one $\gamma$ oscillation (though such an excitation represents a mixture of oscillations and rotations) and an adiabatic concept in which the dynamic variables $\beta$ and $\gamma$ were replaced by $\beta_0$ and $\gamma_0$. Both concepts produced identical results for nuclei with positive-parity levels. Comparisons were made of both concepts for negative-parity levels with octupole oscillations in nonaxial rare earth and transuranic ($^{232}$Th, $^{232}$U, $^{152}$Sm, $^{154}$Gd, $^{160}$Dy, $^{172}$Yb, $^{182}$W, $^{184}$W, $^{186}$W, $^{186}$Os, $^{188}$Os, and $^{190}$Os) nuclei. (R.V.J.)

**44826** ANALYSIS OF THE $^{12}$C(d,$\alpha_0$)$^{10}$B REACTION. Wang, Fan; Ching, Han-wen; Tsiao, Hui-yu. Wu Li Hsueh Pao, 22: 611-14(May 1966). (In Chinese).

**44827** THE COULOMB PHOTODISINTEGRATION OF THE DEUTERON AS A SPECIFIC CASE OF THE THREE-BODY PROBLEM. **Zhmailo, V. A. Yadern. Fiz., 3: 1022-31(June 1966). (In Russian).**

An integral equation suggested by Baz [Nucl. Phys. 51: 145(1964)] to solve (in a specific case) the three-body problem in quantum mechanics is applied to the disintegration of a deuteron in the Coulomb field of a heavy nucleus. This equation is modified to obtain an equation suitable for successive approximations, which is then solved. The amplitude for the Coulomb disintegration of the deuteron is expressed in terms of this solution and compared with the corresponding amplitude found by Landau and Lifshitz. The low values of the corrections obtained show that effects connected with the two-particle character of the deuteron and the difference between the center of mass and center of charge are taken into account with good accuracy in the Landau-Lifshitz method, but quite wrongly in the distorted-wave approximation [C. Wong and R. Gold, Phys. Rev. 132: 1942(1964)] as applied to this problem. (auth)

**44828** MEASUREMENT OF THE NONELASTIC SCATTERING CROSS SECTION OF ALUMINUM BY A 2.52-Bev NEUTRON. Wu, Mei-chen; Wei, Pao-wen; Chu, Yung-ch'in; Ch'en, Chin-hsien; Chang, Kuang-yang. Yuan Tzu Neng, No. 2, 137-43(1965).

The results of some experiments on the measurement of the nonelastic scattering cross section of aluminum are presented. The aluminum spherical shell studied had a 16-cm outside diameter and 8-cm inner diameter. The 2.52-Bev neutrons used for the measurement were obtained by using a high-voltage accelerator to produce a 300-kv gas beam, directed at a heavy water target and passed through a D(d,n)He′ reaction which emits neutrons at 90°. The heavy water emits neutrons at a rate of $1.8 \times 10^8$ neutron/sec. An anthracene crystal 0.02 mm thick was used as a particle detector in the D(d,p) t reaction. Inside the shell, zinc sulfide plastics were used as a neutron detector. The method of alternate data recording was used to avoid relative errors of the instruments; the resultant statistical error is less than 0.5%. The fundamentals, the test set up, the neutron source, the particle detector, the resulting data, and various corrections and error analyses are discussed. (ATD)

**44829** ELASTIC SCATTERING OF 0.5-Mev GAMMA RAYS BY HEAVY ELEMENTS. **Hauser, Ulrich; Mussgnug, Bernd (Univ., Heidelberg). Z. Phys., 195: 252-72(1966).**

The absolute differential cross sections for the elastic scattering of 0.511-Mev gamma rays were measured in the angular range from 0.5 to 10° for elements with Z = 72 to Z = 92. The experimental method, employing annihilation radiation in coincidence, permits the investigation at very small momentum transfer. In general, the results obtained are in very good agreement with the prediction $Z^2r_0^2$ for the differential Rayleigh cross section at $\theta = 0°$ and with the form factor theory, using Hartree-Fock-Slater wave functions, for the investigated angular range. However, for the elements lead, bismuth, and thorium marked deviations from the form-factor predictions were observed at very small scattering angles. This is attributed to an outer atomic charge distribution different from the other investigated elements, which is also indicated by considerably greater metallic radii. Also effects due to the crystalline structure cannot be excluded. Further, an elastic, resonance-like and Z-dependent scattering effect by bound electrons is discussed, which is due to the formation of an intermediate, bound positronium state by electron-positron pairs. (auth)

**44830** SINGLE-PARTICLE LEVELS IN A DEFORMED ENERGY-DEPENDENT NUCLEAR POTENTIAL. **Roeper, Peter (Univ., Frankfurt am Main). Z. Phys., 195: 316-42(1966). (In German).**

The nucleon wave functions and energy eigenvalues in a spheroidal potential well of the Woods-Saxon type are calculated approximately by diagonalizing the Hamiltonian in a finite subspace of Hilbert space. The depth of the potential well is made energy dependent to account for the nonlocality of nucleon-nucleus interaction. With the pairing theory of residual interaction taken into consideration, these results are used to determine nuclear deformation, the energy of single-particle excited states, and magnetic moments of nuclei with mass number about 177. Several methods are applied to calculate the equilibrium deformation; they all yield nearly identical results. The experimentally given low-energy spectra of odd-A nuclei, however, could not be reproduced satisfactorily. Some pronounced discrepancy between calculated and measured magnetic moments, as observed by Mottelson and Nilsson, could not be reduced, either, although in other cases there is considerable improvement to their results. When comparing the structure of the calculated single-particle scheme with the observed sequence of nuclear levels one is led to the conclusion that better agreement will be found for a somewhat different deformation: the nuclear shape will be given by a spheroid necked in to some degree by the equator and thickened at the ends. (auth)

**44831** BETA SPECTRA OF RaD. **Bashilov, A. A.; Chervinskaya, L. S. Zap. Leningr. Gorn. Inst., 44: 119-25(1965). (In Russian).**

The $\beta$ spectrum, the internal conversion electrons, and the Auger electrons produced upon decay of RaD were investigated with a $\beta$ spectrometer of the ketron type. The input film of the Geiger-Muller counter passed electrons with 1.2 kev, and an accelerating voltage up to 1.2 kv was used ahead of the detector. A very thin source was deposited on an aluminum substrate 1 mg/cm² thick. It was established that the $\beta$ spectrum of RaD consists of two components with end-point energies 14.8 ± 0.7 and 61.3 ± 0.7 kev, and with intensities 59 ± 5 and 41 ± 5%. The values of log ft are respectively 5.4 and 7.4. It was established that the total intensity of the $\gamma$ transition in RaE, with an energy 46.5 kev, is equal to 62 ± 5%, which agrees with the $\beta$ spectrum results. It is known that the ground state of RaE has characteristics $1^-$. The data obtained confirm that the level with 46.5 kev has characteristics $0^-$ and that first-forbidden $\beta$ decays from the ground state of RaD with characteristics $0^+$ go to the ground state of RaE and to this level. (JPRS)

**44832** MAGNETIC HYPERFINE STRUCTURE OF $^{155}$Gd LEVELS IN METALLIC GADOLINIUM AND IN THE INTERMETALLIC COMPOUND GdAl$_2$. **Delyagin, N. N.; El Sais, Khussein; Shpinel, V. S. (Moscow State Univ.). Zh. Eksp. Teor. Fiz., 51: 95-100(July 1966). (In Russian).**

The hyperfine structure of the ground state and 86.5-

kev state of $^{155}$Gd was investigated by means of the Mössbauer effect in metallic gadolinium and in the intermetallic compound $GdAl_2$ at a temperature of 80°K. The measurements were performed with an $^{155}$Eu source in the samarium oxide lattice; at temperatures close to that of liquid nitrogen, $^{155}$Eu emits an unsplit natural width line. The absorption spectra obtained indicate that the spin of the 86.5-kev level is $\frac{5}{2}$, and the ratio of the g factors for the excited and ground states is $-2.1 \pm 0.3$. The intrinsic magnetic field strengths on the gadolinium nuclei were found to be respectively 366 ± 55 and 134 ± 25 kOe for metallic gadolinium and $GdAl_2$. Extrapolation to lower temperatures yields a field strength value of 167 ± 25 kOe for gadolinium nuclei in $GdAl_2$. The large difference in the intrinsic magnetic fields in gadolinium and $GdAl_2$ is not accompanied by an isomer shift. No level shift due to quadrupole interaction was detected for gadolinium or $GdAl_2$. The experimental value of the magnetic moment for the 86.5-kev level $(+0.85 \pm 0.13)\ \mu$ is not consistent with the value calculated from the Nillsson model. (auth)

**44833** CURRENT AND MAGNETIC FIELD OF A ROTATING NUCLEUS. Grin, Yu. T.; Zaitsev, R. O. Zh. Eksp. Teor. Fiz., 51: 639-43(Aug. 1966). (In Russian).

The current corresponding to vortex and potential motions of a nucleus and its magnetic field were calculated. The correction to the moment of inertia of the nucleus due to the magnetic field was found to equal 0.3%. (auth)

**44834** ISOBARIC SPIN REACTIONS IN LIGHT NUCLEI. Browne, Cornelius P. (Univ. of Notre Dame, Ind.). 26p. (CONF-660306-15). ORAU. Gmelin, AED-CONF-66-048-13.

From American Physical Society, Conference on Isobaric Spin, Tallahassee.

Deuteron inelastic scattering, (d,$\alpha$) reactions, ($\alpha$,d) reactions, and $^6$Li-induced reactions on nuclei with $A \leq 40$ are discussed. Even-A nuclei in the first row of the periodic table are emphasized. Some reactions are discussed in which problems with angular momentum are avoided. It is shown that (d,$\alpha$) reactions can be analyzed to disentangle isobaric spin effects from angular-momentum, penetrability, and, to some extent, reaction-mechanism effects. (D.C.W.)

**44835** DIFFERENTIAL CROSS SECTIONS OF $^{16}$O(d,p)$^{17}$O. deForest, F. G. (Univ. of Wisconsin, Madison). 9p. (CONF-651015-25). ORAU. Gmelin, AED-CONF-1965-312-45.

From American Physical Society Meeting, Chicago.

The low-lying energy levels of $^{17}$O were investigated using the $^{16}$O(d,p)$^{17}$O reaction at 6.00 to 8.55 Mev. Angular distributions for the first nine proton groups were measured. An attempt was made to determine the spin and parity of the sixth excited state of $^{17}$O. (D.C.W.)

**44836** USE OF GREEN FUNCTIONS IN NUCLEAR THEORY. Koshel, R. D. (Ohio Univ., Athens). 8p. (CONF-660430-1). ORAU. Gmelin, AED-CONF-66-105-1.

From Ohio Academy of Science, 75th Annual Meeting, Columbus, Ohio.

The Green-function method of obtaining scattering solutions to the Schroedinger equation is investigated. It is shown that the method can be used to obtain information on nuclear structure. (D.C.W.)

**44837** ANALOG STATES IN $^{55,57}$Co AND $^{59,61}$Cu EXCITED BY ($^3$He,d) REACTIONS. Rosner, B.; Holbrow, C. H.; Pullen, D. J. (Univ. of Pennsylvania, Philadelphia). 11p. (CONF-660306-13). ORAU. Gmelin, AED-CONF-66-048-10.

From American Physical Society, Conference on Isobaric Spin, Tallahassee.

Angular distributions and deuteron spectra from the reaction ($^3$He,d) on $^{54}$Fe, $^{56}$Fe, $^{58}$Ni, and $^{60}$Ni at 16.5 Mev were measured. States in $^{55}$Co, $^{57}$Co, $^{59}$Cu, and $^{61}$Cu corresponding to states in $^{55}$Fe, $^{57}$Fe, $^{59}$Ni, and $^{61}$Ni were identified. The differences between the Coulomb energies of analog pairs were calculated from the excitation energies of the ground-state analogs and the atomic masses. (D.C.W.)

**44838** ENERGY LEVELS OF $^{37}$K. Goosman, D. R.; Kavanagh, R. W. (California Inst. of Tech., Pasadena). 9p. (CONF-660906-4). ORAU.

From International Conference on Nuclear Physics, Gatlinburg, Tenn.

Approximately 40 levels were observed in $^{37}$K by the reactions $^{40}$Ca(p,$\alpha$)$^{37}$K, $^{36}$Ar($^3$He,d)$^{37}$K, $^{36}$Ar(d,n)$^{37}$K, $^{36}$Ar (p,p$_1\gamma$)$^{36}$Ar, $^{36}$Ar(p,$\gamma$)$^{37}$K, and $^{36}$Ar(p,p)$^{36}$Ar. The analogues in $^{37}$K to the first two excited states in $^{37}$Ar were found at 1.368 ± 0.003 Mev with $J^\pi = \frac{1}{2}^+$ and at 1.380 ± 0.001 Mev with $J^\pi = \frac{7}{2}^-$ and $\tau_{1/2} = 9.6 \pm 1.4$ nsec. The spins, parities, and isospins of several other levels were also determined. (D.C.W.)

**44839** $^{40}$Ca(d,p)$^{41}$Ca PROTON POLARIZATION NEAR THE j-DEPENDENT CROSS-SECTION MINIMUM. Foster, C. C.; Maddox, W. E.; Miller, D. W. 12p. (CONF-650410-49). ORAU. Gmelin, AED-CONF-65-073-101.

From American Physical Society, 1965 Spring Meeting, Washington, D. C.

The polarization of protons from the $^{40}$Ca(d,p)$^{41}$Ca reaction exciting the $J = \frac{1}{2}^-$, 3.95 Mev state of $^{41}$Ca was measured at three angles near the j-dependent minimum in the angular distribution. These studies are expected to provide additional information that might be useful in understanding the mechanism responsible for the observed j-dependence of the angular distributions for various nuclear reactions. (S.F.L.)

**44840** ENERGY LEVELS IN $^{14}$N FROM $^{14}$N(p,p')$^{14}$N. Messelt, S. (Univ. of Wisconsin, Madison). 12p. (CONF-660411-46). ORAU. Gmelin, AED-CONF-66-060-95.

From American Physical Society Meeting, Washington, D. C.

The inelastic scattering of protons by $^{14}$N was studied in the energy range from 7 to 11 Mev using a differentially pumped gas scattering chamber. Energy levels in $^{14}$N were investigated. (S.F.L.)

**44841** ISOSPIN SELECTION RULE IN THE $^{28}$Si(d,$\alpha$)$^{26}$Al REACTION. Bizzeti, P. G.; Bizzeti-Sona, A. M. (Max-Planck-Institut fuer Kernphysik, Heidelberg). 9p. (CONF-660306-16). ORAU. Gmelin, AED-CONF-66-048-17.

From American Physical Society, Conference on Isobaric Spin, Tallahassee.

Some preliminary results are presented from a systematic investigation of the $^{28}$Si(d,$\alpha$)$^{26}$Al reaction, involving the isospin forbidden transition to the first ($O^+$, T = 1) excited state of $^{26}$Al. The effect of the isospin selection rule was studied in the overlapping level region, where the dynamic criterion [H. Morinaga, Phys. Rev. 97: 444(1955)] for isospin conservation can be expected to hold. (S.F.L.)

**44842** STUDY OF (d,p) AND (d,t) REACTION ON THE $^{136}$Xe ISOTOPE. Schneid, Edward J.; Rosner, Baruch (Univ. of Pittsburgh). 24p. (CONF-650653-29). ORAU. Gmelin, AED-CONF-66-060-103.

From American Physical Society, Summer Meeting, New York.

Eight levels of $^{137}$Xe and seven of $^{135}$Xe were observed in the $^{136}$Xe(d,p) and $^{136}$Xe(d,t) reactions. The angular distributions of the proton and triton groups were analyzed using zero-range DWBA calculations to extract spectroscopic information. Spin and parity assignments for most of the observed states were attempted. Comparison with (d,p) and (d,t) reactions on $^{138}$Ba, $^{120}$Ce, and $^{142}$Nd reveals that the multiplicity of the hole states in the N = 81 isotones is much lower than the particle states in the N = 83 isotones. (auth)

**44843** SECOND ORDER CORRECTIONS TO ROTATIONAL SPECTRA IN DEFORMED EVEN EVEN NUCLEI. Gupta, Raj K. (Toronto Univ.); Sood, P. C. 6p. (CONF-660411-8). ORAU. Gmelin, AED-CONF-66-060-32.

From American Physical Society Meeting, Washington, D. C.

The effect of including a second-order correction term in the ground-state rotational band for the Bohr-Mottelson hydrodynamical collective nuclear model is examined. It is found that for $^{190}$Os, $^{191}$Os, $^{192}$Os, $^{222}$Ra, and all transitional nuclei with N = 90 the rotational model is unsatisfactory. For the other transitional nuclei the second-order correction was found to be essential for reasonable agreement, even for nuclei showing small deviations from the energy ratios for pure rotation. (S.F.L.)

**44844** ISOSPIN POTENTIAL TERM WITH LOCAL AND NON-LOCAL INTERACTIONS. Sood, P. C. (Univ. of Alberta, Edmonton). 10p. (CONF-660306-17). ORAU. Gmelin, AED-CONF-66-048-20.

From American Physical Society, Conference on Isobaric Spin, Tallahassee.

The isospin-dependent term in the nuclear potentials using nonlocal interaction is related to the corresponding term using local interaction employing the Perey-Buck local approximation. Relations are derived corresponding to two choices corresponding to the same energy dependence of the neutron and the proton potentials, and to the same range of non-locality for the two potentials. It is concluded that for the former choice a consistent description results if the potentials are written as $V_0(1 \pm \tau(N-Z)/A)$. For a given isospin dependence of the phenomenological local potential, the modification introduced is significantly different for the two choices. The importance of undertaking an analysis of the proton scattering data with nonlocal potentials to help clarify the situation is pointed out. (auth)

**44845** DECAY OF $^{145}$Eu. Hill, John C. (Purdue Univ., Lafayette, Ind.). 33p. (CONF-660107-63; COO-1420-118). ORAU. Gmelin, AED-CONF-66-003-151.

From American Physical Society Meeting, New York.

The decay scheme of $^{145}$Eu was studied using $\beta$ and $\gamma$ spectroscopy. The half life was measured to be 5.93 ± 0.1 days. Thirty-three gamma transitions were identified using NaI and germanium gamma detectors and 180° magnetic spectrometers. Gamma-gamma coincidences were performed using both NaI and germanium detectors. Most of the transitions were incorporated into the decay scheme in a consistent manner. The multipolarity of several gamma transitions was determined from measurement of conversion coefficients, and a positron spectrum containing two branches was observed. The level scheme of $^{145}$Sm contains a first excited state at 0.895 Mev and a second excited state at 1.437 Mev. Above 1.5 Mev, the level density greatly increases. Levels with both even and odd parities were observed, and the energy between the ground states of $^{165}$Eu and $^{145}$Sm was determined to be about 2.75 Mev. Systematics for the first excited states of nuclei with even proton number and neutron number near 82 are presented. (auth)

**44846** OPTICAL MODEL FOR ELASTIC DEUTERON SCATTERING. Baumgaertner, G. Munich, Technical Univ., 1966. 40p. $2.00 Gmelin, AED-Diss. 66-6.

Thesis.

An optical potential for the deuteron is defined and calculated including Pauli's principle and finite extension. For infinitely extended nuclear matter, the Pauli principle changes the potential obtained by simple addition of single-particle potentials only insignificantly. The binding energy of a deuteron in nuclear matter is nearly equal to that of a free deuteron. The first term of perturbation theory agrees fairly well with experimental data. The second term is at least 2 orders of magnitude smaller than the first. (Gmelin)

**44847** AN APPLICATION OF THE GREEN FUNCTION OF DIRAC'S EQUATION IN ELECTRON SCATTERING. Nelles, H. Cologne, Univ., 1965. 51p. $2.00 Gmelin, AED-Diss. 65-375.

Thesis.

The differential scattering cross section is calculated from an asymptotic solution of Dirac's equation. The asymptotic solution is obtained from Green functions. This method is valid for small Z and high momentum transfer to the nucleus. (Gmelin)

**44848** THE CONVERSION ELECTRON SPECTRUM OF $^{104}$Rh AFTER ELECTRON CAPTURE. Bieber, E. Munich, Technical Univ., 1965. 37p. $2.00 Gmelin, AED-Diss. 65-327.

Thesis.

The $\beta$ spectrometer at the FRM reactor was readjusted by photographic methods. The smallest line resolution is 0.07% on the momentum scale. The sensitivity was increased by a Bi absorber between reactor core and beam tube. Causes of background are discussed. In the conversion spectrum of $^{104}$Rh, 70 lines were found corresponding to 55 transitions. Multipole orders are determined in most cases so that it was possible to assign spin and parity values to some low-lying energy levels of $^{104}$Rh. (Gmelin)

**44849** STUDIES OF THE REACTION $^{12}$C(n,n')3 $\alpha$. Moesner, J. Dresden, Technical Univ., 1965. 83p. $2.00 Gmelin, AED-Diss. 65-316.

Thesis.

The mechanism of the reaction $^{12}$C(n,n')3$\alpha$ was studied using a cloud chamber and 15.5-Mev neutrons. 1267 triple $\alpha$'s were observed. All the events can be explained by decays from the levels of $^{12}$C and $^{8}$Be. The process can be described by the cluster model. (Gmelin)

# Plasma Physics and Thermonuclear Processes

## See *also* Fluid Physics and Thermodynamics

*Refer also to abstracts 43123, 43638, and 44167.*

**44850** (AD-628506) DEVELOPMENT OF AN ULTRA-FAST MODERATE ENERGY PULSE POWER SYSTEM. Technical Report, April 1962–July 1964. Trolan, J. K. (Field Emission Corp., McMinnville, Oreg.). Jan. 1966. Contract AF29(601)-5376. 311p. (AFWL-TR-65-1). CFSTI $30.70 cy, $1.50 mn.

A unique pulse power system was constructed which generates very high-energy-density plasmas for the specific purpose of determining the electrical, thermodynamic, and radiative properties of materials at high temperatures. Theoretical indications suggest that if a sufficiently fast rate of energy transfer is achieved, a very high temperature can be obtained even when there is only moderate stored energy (about 1000 joules) in the system. Therefore, the system was designed to provide a very fast-rising pulse (less than 8 nsec to a peak current of approximately 70,000 amperes of short duration (50 nsec) for the case of a constant and matched 4.7-ohm load impedance. System design features are discussed including the parallel coupling of 15 synchronized 320-kv Marx-surge generators to an evacuatable transducer chamber by means of a multiple-input matched impedance transmission line. The developmental engineering of each of the major system components is documented, indicating the processes employed to ensure maximum system usefulness and reliability. (auth)

**44851** (AD-628777) ELECTRON COLLISION FREQUENCY VERSUS CHARGED PARTICLE SEEDING. Hoffman, J. (MITRE Corp., Bedford, Mass.). Feb. 1966. Contract AF19(628)-2390. 21p. (ESD-TR-65-402). CFSTI $2.60 cy, $0.50 mn.

One method of controlling electromagnetic plasma interaction is by seeding the plasma with highly charged particles to obtain relatively large values of the collision frequency. A description is given of the maximum obtainable collision frequency as a function of ultrafine charged particle seeding parameters. (auth)

**44852** (AD-629924) ATOMIC DENSITY MEASUREMENTS IN NITROGEN, OXYGEN, AND HYDROGEN AFTERGLOW PLASMAS. McLennan, Ewen A. (Illinois Univ., Urbana. Gaseous Electronics Lab.). Feb. 1966. Contract AF19(628)-3307. 93p. (AFCRL-66-88). CFSTI $3.00 cy, $0.75 mn.

Densities of ground-state N, O and H atoms, formed by dissociation of the parent molecular gases in d-c and r-f discharges, were measured over the range 10 to the 10th power to 10 to the 16th power/cc. Sensitive and unambiguous measurements that did not disturb the system under study were made by electron spin resonance (ESR) and atomic resonance absorption spectroscopy (RAS). Quantitative measurements were made by calibration of the atomic ESR resonance lines against an $O_2$-ESR resonance line standard. Densities determined by ESR and by gas titration agreed within 20%. Densities of ground-state atoms were investigated in the afterglows of pulsed and continuous r-f discharges, and pulsed d-c discharges, in both stationary and flowing gases. Dissociation of the parent molecular gas was found to be a strong function of the type of discharge and of the gas impurity content; r-f discharges in gases with a few tenths percent $H_2O$ impurity typically produced four orders of magnitude more atoms than did pulsed d-c discharges in "pure" gases. Atomic densities were measurable up to 10 sec in r-f discharge afterglows. The slow recombination of the atoms provides a long-lived energy source throughout the afterglow. Experiments were performed to show that the concentration of N atoms in the afterglow of a pulsed d-c discharge in $N_2$ markedly affects the electron density, temperature, and collision frequency. (auth)

**44853** (AD-630040) EXPERIMENTS ON WAVE INTERACTIONS BETWEEN PLASMA AND AN ELECTRON STREAM IN A MAGNETIC FIELD. Apel, J. R.; Stone, A. M. (Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.). Oct. 1965. Contract NOw-62-0604-c. 21p. CFSTI $1.00 cy, $0.50 mn.

Experiments have been conducted on the UHF wave interactions between a plasma and an electron stream, and comparisons made between the measured and calculated values of frequencies and wavelengths. The apparatus consists of a plasma source producing a plasma column 1 cm in diameter with $n_e$ adjustable between 10 to the 9th power and 10 to the 13th power/cc; an electron gun yielding 180 ma at 2000 volts, flowing coaxially with the plasma; and a collimating magnetic field of 200 oersted intensity. The theory and measurements show the instability to be due to the interaction of the electron cyclotron wave in the plasma with the "plasma wave" in the beam. (auth)

**44854** (AD-630074) AN INVESTIGATION OF ELECTRONIC RECOMBINATION IN HELIUM AND ARGON AFTERGLOW PLASMAS BY MEANS OF LASER INTERFEROMETRIC MEASUREMENTS. Gusinow, M. A.; Gerardo, J. B.; Verdeyen, J. T. (Illinois Univ., Urbana. Gaseous Electronics Lab.). Feb. 15, 1966. Contract DA-ARO(D)-31-124-G582. 118p. (AROD-4832:7). CFSTI $4.00 cy, $0.75 mn.

Two helium-neon laser interferometers were used to obtain the electron and neutral atom densities in an afterglow plasma. The interferometric technique utilized allows one to obtain both the spatial and temporal dependence of the electron decay. The two gases studied were helium and argon at 2−8 Torr and 0.3−0.8 Torr respectively. The electron density was in the range of $2 \times 10$ to the 13th power <N (e) 10 to the 15th power/cu cm and the electron temperature in the range 1000 < T (e) < 7000 K. The electron temperature was measured by comparing the relative atomic line intensities and by inference from the recombination coefficient. The electronic recombination in helium, argon, and helium-argon mixtures was found to follow closely the predictions of Bates, Kingston, and McWhirter for collisional-radiative recombination (Proc. Phys. Soc. 83: 43(1964)). In the range of electron temperature and density studied the recombination coefficient exhibited an approximate T to the $-{}^{9}/_{2}$ power dependence. The electron temperature inferred from the measured recombination coefficient indicates a pronounced electron temperature gradient across the tube which is believed to be due to electron heating effects in the afterglow. (auth)

**44855** (IAE-1078) VREMYA ZHIZNI OTDEL'NYKH ZARYAZHENNYKH CHASTITS V MAGNITNOI LOVUSHKE S PROBKAMI. (The Lifetime of Individual Charged Particles in Mirrored Magnetic Trap). Balebanov, V. M.; Semashko, N. N. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii, SSSR, Moscow). 1966. 60p. Dep. mn.

The lifetime of individual charged particles in stationary magnetic-mirror traps was measured as function of the various pertinent parameters. Comprehensive theoretical derivations support numerous experimental data presented in the form of graphs and tables. Results confirm the theoretical predictions of the exponentially small character of the changes in magnetic moments relative to the adiabatic parameter during particle motion near the reflection point. For a given Orgy-I magnetic field configuration, the exponent and coefficients of the exponential term of the expression for the change of magnetic moment assuming random and resonant accumulation processes were found. Lifetimes measured in the presence of axially symmetric perturbations of the magnetic field are in satisfactory agreement with the newly derived theoretical expression. For conditions corresponding to absolute retention of particles within a limited space (in "Stoermer zones") there appeared an anomalous increase in electron lifetimes within the trap. (JPRS)

**44856** (IAE-1152) VLIYANIE POPERECHNYKH TOKOV NA RAVNOVECIE TOROIDALNOI PLAZMY PRI NALICHII PROVADYASHCHEGO KOZHUKHA. (The Influence of Transverse Currents on the Equilibrium of Toroidal Plasma in the Presence of Conducting Walls). Mukhatov, V. S. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). [1965]. 16p. Dep. mn.

In the Tokomak units the plasma loop is formed by means of a metallic diaphragm, and theoretically, the equilibrium position of the plasma loop in the conducting sheath should be shifted outwards. A plasma of noticeable density should be observed at the edges of the diaphragm and at certain parts of its shadow. Transverse currents due to toroidal charge drift can be grounded through the diaphragm in this way. On the Tokamak-5 unit it is found experimentally that with an ordinary (annular) diaphragm the effect of current short-circuiting via the diaphragm on the equilibrium of the plasma loop is negligibly small under typical discharge conditions. At the same time it is possible to modify the discharge conditions in such a fashion that the effect of these currents on the plasma equilibrium becomes noticeable. A difference in potential between two molybdenum strips (simulating a diaphragm) is created by an external feed source so as to obtain a transverse current in the plasma. The effect of this current on the equilibrium of the plasma loop agrees well with that predicted by theory. (TTT)

**44857** (IAE-1153) OPREDELENIE PROSTRANSTVENNOGO RASPREDELENIYA PLOTNOSTI PLAZMY MNOGOLUCHEVYM MIKROVOLNOVYM ZONDIROVANIEM. (Plasma Density Spatial Distribution Measurements by Means of Multi Beam Microwave Probing). Gorbunov, E. P.; Dnestrovskii, Yu. N.; Kostomarov, D. P.; Mul'chenki, B. F. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). [1965]. 16p. Dep. mn.

The electron density distribution in the transverse cross-section of a plasma cylinder can be determined by measuring the phase shift of millimeter waves sent through different parts of the plasma in two mutually perpendicular directions. Axial symmetry is assumed. However, during the time of discharge the plasma loop changes its position with respect to the center of the chamber so that it is possible to disturb the axial symmetry in the distribution of plasma along the cross-section of the loop. Hence a method of determining the electron density distribution is developed for the case where axial symmetry is lacking. It is assumed that the form of the lines along which the plasma density remains constant is known, and that only the density along the lines need be determined. A method of solving this problem is presented, and a concrete example is worked out with the use of actual experimental data. It is necessary to solve a first-order integral equation by numerical methods. Analysis shows that axial symmetry is maintained at the initial and middle portions of the discharge, but that symmetry is disturbed at the end of the discharge with a shift in the horizontal direction. (TTT)

**44858** (IPP-6/48) AXIALSYMMETRISCHE MAGNETOHYDROSTATISCHE GLEICHGEWICHTE. (Axisymmetric Magnetohydrostatic Equilibria). Merkel, P.; Schlueter, A. (Institut fuer Plasmaphysik, G.m.b.H., Garching (West Germany)). Feb. 1966. 40p. Dep. mn.

An approximate solution of an axisymmetric magnetohydrostatic equilibrium without longitudinal currents is given. In this case the equilibrium problem leads to a partial differential equation for the flux function F(s,z). The pressure p is a function of F(s,z) only. This function, which can be chosen arbitrarily, is taken here as $p(F) = \frac{1}{2} - \frac{1}{\pi}$ arctg bF. Then in first approximation the partial differential equation can be reduced to a system of ordinary differential equations and the solution shows that this particular choice of p(F) ensures decreasing pressure in the radial direction. The magnetohydrodynamic stability of the equilibrium solutions is studied. The calculations based on a criterion given by Bernstein et. al. show instability for all solutions. There are in fact solutions which are locally stable in regions with sufficiently high pressure gradient and sufficiently small curvature of the lines of force, but on the whole instability results. (auth)

**44859** (IPP-6/53) GLEICHGEWICHT UND STABILITAET EINES PLASMAS MIT OBERFLAECHENSTROEMEN. (Equilibrium and Stability of a Plasma with Surface Currents). Wobig, Horst (Institut fuer Plasmaphysik, G.m.b.H., Garching (West Germany)). July 1966. 54p. Dep. mn.

The equilibrium and stability of toroidal plasma configurations which were found by F. Meyer and H. U. Schmidt [Zeit. fur Naturf. 13a, 1005(1958)]. These so-called M and S surfaces are characterized by a vanishing total azimuthal current ($I_{az} = 0$). Starting point is the model of a fieldless plasma with surface currents. From the equilibrium condition $B^2 = 8\pi p$ we obtain a differential equation for the surface S. $\sum_{i,k} g\,(^{ik}\partial\phi/\partial x^i)\,(\partial\phi/\partial x^k) = 1$ ($g_{ik}$ = metric tensor of S; $\phi : \vec{B} = \Delta\phi$ on S; p = plasma pressure; $x^i(i = 1, 2)_1$ = surface parameter). The surface S is described by its distance $r(x^1, x^2)$ to a closed reference line. If $\phi(x^1, x^2)$ is given, the equation above yields a differential equation for $r(x^1, x^2)g_{ik} = g_{ik}[r_1(\partial r/\partial x^1), (\partial r/\partial x^2)]$. It is shown how to obtain approximately a solution of this equation. The stability is investigated using the energy principle of magnetohydrodynamics. It is shown, that the equilibrium surfaces calculated by Meyer and Schmidt are unstable against pure interchange perturbations ($\delta\vec{B} = 0$). Furthermore a stability criterion for interchange disturbances is given. In the limit of a vanishing aspect ratio (linear bumpy $\vartheta$-pinch) we also consider perturbations which change the magnetic field ($\delta\vec{B} \neq 0$). Instability for perturbations with constant amplitude along the magnetic field lines is obtained. The growth rates are estimated. (auth)

**44860** (JUL-352-PP) BREAKDOWN OF AN ELECTRODELESS RING DISCHARGE AND THE DEVELOPMENT OF THE ELECTRON DENSITY AND TEMPERATURE IN A SPINDLE CUSP. Belitz, H. J.; Kugler, E. (Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik). Jan. 1966. 12p. Dep. mn.

The magnetic field, electron temperature and density of a hydrogen plasma, generated by discharging a 0.5 μF, 25kv condenser to a pair of conical coils producing a cusp shaped magnetic field, have been measured space and time resolved. Electron densities of $10^{16}$ to $10^{17}$ cm$^{-3}$ and electron temperatures of 1.5 to 3 ev were obtained from Stark broadening of $H_\beta$, from the absolute intensity of the continuum and from the relative intensity of $H_\beta$/continuum respectively. By combining the results with magnetic probe measurements a consistent picture of the plasma can be proposed. (auth)

**44861** (NASA-CR-596) ESTIMATES OF NONEQUILIBRIUM IONIZATION PHENOMENA IN THE INVISCID APOLLO PLASMA SHEATH. Dunn, M. G.; Daiber, J. W.; Lordi, J. A.; Mates, R. E. (Cornell Aeronautical Lab., Inc., Buffalo, N. Y.). Sept. 1966. Contract NAS5-3976. 63p. (CONF-650978-1). CFSTI $2.50 cy, $0.75 mn.

From 3rd Symposium on the Plasma Sheath-Plasma Electromagnetics of Hypersonic Flight, Boston, Mass.

Estimates of nonequilibrium ionization phenomena in the asymmetric plasma sheath were made for an Apollo-type body centering the earth's atmosphere at superorbital velocity. For an entry velocity of 30,000 ft/sec and an attack angle of 20°, results are presented for altitudes of 200,000 ft and 250,000 ft. for the pitch plane. The charged species are taken as $N_2^+$, $O_2^+$, $NO^+$, $N^+$, $O^+$ and $e^-$. The dominant electron-depletion reactions are shown to be $NO^+ + e^- \rightarrow N + O$, $N_2^+ + e^- \rightarrow N + N$, $N^+ + e^- + e^- \rightarrow N + e^-$, and $O^+ + e^- + e^- \rightarrow O + e^-$. Other important chemical reactions involving the charged species are discussed for various portions of the plasma sheath. Contours of electron density in the forebody and near afterbody region are presented for altitudes of 200,000 ft. and 250,000 ft. For the 200,000 ft. case, the maximum forebody electron density in the stagnation region is calculated to be approximately $5 \times 10^{15}$ electrons/cm$^3$. In the windward corner region the electron density is on the order of $5 \times 10^{13}$ electrons/cm$^3$ and in the leeward corner region, is approximately $5 \times 10^{12}$ electrons/cm$^3$. Corresponding values of electron density for an altitude of 250,000 ft. are found to be approximately 50 times less. Electron-neutral and electron-ion collision frequencies are also calculated along each streamline in the plane of symmetry. The solution for an altitude of 200,000 ft. indicated a maximum electron-neutral collision frequency in excess of $1 \times 10^{10}$ rad/sec in the forebody region. The electron density distribution and the collision frequency distribution for two selected paths through the plasma sheath are presented. The peak electron densities and collision frequencies for these paths occur at a significant distance from the body. The high electron density and collision frequencies in the inviscid flow field emphasize the importance of the inviscid flow field chemical kinetics. Additionally, they suggest that the influence of ablation products and viscous effects on the electromagnetic propagation should be more closely evaluated. The attenuation for the propagation of one-dimensional plane waves along these two paths is presented. The implication of these results is that for the particular trajectory position and transmission paths selected it would be exceedingly difficult to communicate with the craft at a carrier frequency in the range of 1 to 10 Gc. (auth)

**44862** (NASA-TM-X-1294) SMALL PLASMA PROBES WITH GUARD RINGS AND THERMOCOUPLES. Morris, James F. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Oct. 1966. 22p. CFSTI $1.00 cy, $0.50 mn.

Ordinary electric probes for ionized gases have thermal and edge effects. In the past, these effects were either the source of errors or the cause of enlarged probes. Now, however, cylindric, spheric, and plane probes with guard rings and thermocouples have been made nearly as small as usual Langmuir probes. Although the primary, guard, and thermocouple elements are effective, these probes are not thermally durable. This deficiency is the result of an absence of microscopic refractory tubing. Because of the lack of proper materials, nickel and ceramic cements were used. Soon, though, small high-temperature probes with guards and thermocouples can be made with tantalum and alumina tubes. These probes will be more resistant to heat and alkali metals and can be used to give more control and knowledge in plasma tests than common probes do. (auth)

**44863** (NP-16310) DREIFOVAYA NEUTOICHIVOST' PLAZMY RAZRYADA S OSTSILLIRUYUSHCHIMI ELEKTRONAMI. (Drift Instability of Plasma Discharge with Oscillating Electrons). Dushin, L. A.; Kuznetsov, Yu. K.; Pavlichenko, O. S. (Akademiya Nauk Ukrainskoi SSR, Kharkov. Fiziko-Tekhnicheskii Institut). 1966. 11p. Dep. mn.

The existence was established earlier (ZhTF, 35, 1401 (1965)) of an anomalous increase in charged particle flow in a direction perpendicular to the magnetic field in discharges with oscillating electrons. The connection between the above drift instability (appearing for above-critical values of the magnetic field and leading to a loss of charged particles from the plasma) and the strong simultaneous low frequency oscillations of the plasmas is reported. The description of the experimental device and the presentation of the recorded data is followed by a comprehensive theoretical discussion which shows that the observed oscillations are caused by the drift-dissipative instability of inhomogeneous plasmas. (JPRS)

**44864** (ORNL–4010) PLASMA-DENSITY MEASUREMENT IN A HOLLOW-CATHODE ARC BY ARC REVERSAL. Alexeff, I.; Halchin, W.; Jones, W. D.; Potts, J. F. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 9p. (CONF-660633–11). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From American Physical Society, Division of Plasma Physics, Minneapolis, Minn.

The average plasma density was measured in a magnetically supported, hollow-cathode arc ($n > 10^{14}$ cm$^{-3}$) by reversing the applied potential. At these high densities, the standard Langmuir probe and microwave techniques are difficult to use, while the "arc reversal" technique is remarkably simple. Since the hot cathode becomes the anode, and since the anode is cold and does not emit electrons, current flow and production of new plasma cease. The ionic charge escaping along magnetic flux lines to the cathode and anode can then be collected and measured. The average density of electrons in the arc is given by $n = 2Q(Ve)^{-1}$, where Q is the charge collected after reversal, V is the volume of the arc, and e is the charge of an electron. From the time required for the ionic charge to escape, the ion temperature can be estimated. The electron temperature apparently can be found from the frequency of ionic sound waves shock-excited by the arc reversal. (auth)

**44865** (ORNL–4011) PRESENT STATUS AND OBJECTIVES OF THE DCX-2 EXPERIMENT. Bell, P. R.; Kelley, G. G.; Lazar, N. H.; Lyon, J. F. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 11p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

It is concluded that the DCX-2 program will lead to an understanding of the factors which determine hot plasma density in the device itself and that there is promise of the attainment of densities in the range of thermonuclear interest. Whether or not this goal is reached, the program is continuing to play an important part in the elucidation of problems leading to controlled thermonuclear power. It is serving as a test for instability theories and is stimulating further theoretical work. It has provided densities in excess of theoretically predicted instability thresholds and in fact has produced the highest densities and plasma pressures yet attained in a high-energy injection device. Future experiments should give definite answers to the question of scaling. The course of action and indeed the feasibility of high-energy injection for thermonuclear power should then be clear. (auth)

**44866** (UCRL–70025) ASTRON ALIGNMENT SYSTEM. Bradley, Eugene T. (Lawrence Radiation Lab., Univ. of California, Livermore). Sept. 23, 1966. Contract W-7405-eng-48. 12p. (CONF-661016–2). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Symposium on Engineering Problems of Controlled Thermonuclear Research, Gatlinburg, Tenn.

The continuing development of the Astron device is discussed. The alignment techniques for using the new 4-Mev accelerator are briefly discussed. (M.O.W.)

**44867** (UCRL–70026) MECHANICAL DESIGN OF THE BASEBALL COIL AND PLASMA-TRAPPING CHAMBER. Bathgate, Robert E.; Neef, William S. Jr. (Lawrence Radiation Lab., Univ. of California, Livermore). Sept. 23, 1966. Contract W-7405-eng-48. 22p. (CONF-661016–1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Symposium on Engineering Problems of Controlled Thermonuclear Research, Gatlinburg, Tenn.

Basic calculations and design considerations of the "baseball seam" conductor and its corresponding vacuum chamber for plasma experiments in the Alice device are described. A discussion is presented of a structural failure encountered during magnet operation, and corrective measures which were taken. (M.O.W.)

**44868** (UCRL–70027) ASTRON MECHANICAL ENGINEERING DESIGN EFFORT. Hurley, Charles A. (Lawrence Radiation Lab., Univ. of California, Livermore). Sept. 23, 1966. Contract W-7405-eng-48. 10p. (CONF-661016–8). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From Symposium on Engineering Problems of Controlled Thermonuclear Research, Gatlinburg, Tenn.

The mechanical engineering effort on the ASTRON program is separated into three categories. The first of these is the support of the existing experimental apparatus. Concurrent with this, are the design and construction of the new main chamber, and the new 4-Mev induction accelerator. These efforts are described. (M.O.W.)

**44869** (AEC-tr–6671) NUCLEAR FUSION (TRANSLATED SELECTED ARTICLES). Translation of Nucl. Fusion, 5: 181-241; 249-50(1965). 150p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

**44870** (AEC-tr–6673) NUCLEAR FUSION (TRANSLATED SELECTED ARTICLES). Translated from Nucl. Fusion, 6: No. 1, 1-5; 9-14; 24-40; 56-66(1966). 98p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

**44871** (CONF-660332–1) ELECTRON IMPACT IONIZATION CROSS-SECTIONS OF IONS. Beigman, I. L.; Presnyakov, L. P. Translated for Culham Lab., United Kingdom Atomic Energy Authority, Abingdon, England, from Paper presented at the Culham Conference on Ultraviolet and X-ray Spectroscopy of Laboratory and Astrophysical Plasmas, March–April 1966. 8p. (CTO–282). Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.10 fs, $0.80 mf.

For an investigation of a high-temperature plasma it is essential to know the ionization and excitation cross sections of the ions by electron impact. When calculating such cross sections the long-range Coulomb field of the ion must be taken into account as its effect on the behavior of the cross section near threshold is important. To show the importance of the Coulomb field of the ion, the ionization cross sections were calculated for different states of the $C^{5+}$ and $C^{4+}$ ions, and the results were averaged over a Maxwellian velocity distribution. (W.D.M.)

**44872** (LA-tr–66-58) DYNAMICS OF NON-CYLINDRICAL Z-PINCH PLASMA SHEATH AT A STAGE PRIOR TO CUMULATION. Kolesnikov, Iu. A.; Filippov, N. V.; Filippova, T. I. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). Translated by Helen J. Dahlby (Los Alamos Scientific Lab., N. Mex.). 18p. Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.60 fs, $0.80 mf.

Pulse discharge studies show that plasma parameters obtained from current cumulation (pinching) depend essentially on the initial stage of formation of the plasma sheath, its structure, and dynamics of motion. Experimental studies carried out in a pinch chamber with metal walls are described. The current reached a maximum value of ~1 ma during the time of ~3 $\mu$sec, with an initial growth rate of $(0.6-1.3) \cdot 10^{12}$ amp/sec. Measurements were carried out with an initial pressure of deuterium of 0.3 to 2 torr. (W.D.M.)

**44873** (MATT-Trans–35) THERMAL INSULATION OF PLASMA IN TOKAMAK. Artsimovich, L. A.; Bobrovskii, G. A.; Mirnov, C. B.; Razumova, K. A.; Strelkov, B. C. (Institut Atomnoi Energii, Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii SSSR, Moscow). Translated for Plasma Physics Lab., Princeton Univ., N. J., from the Russian. 22p. (CONF-660717–1). Dep. mn. CFSTI $2.00 cy, $0.50 mn. JCL $2.60 fs, $0.86 mf.

From International Symposium on Experimental and Theoretical Aspects of Toroidal Confinement, Princeton, N. J.

As a measure of the effectiveness of the thermoinsulation in installations designed for production and retention of high temperature plasmas, the quantity $\tau_\epsilon$, defined from the condition

$$\tau_\epsilon = \frac{W}{Q-\frac{dw}{dt}},$$

is used. W is the total energy of plasma configuration, Q is the quantity of heat arriving at the plasma from heat sources per unit of time, and the quantity $\tau_\epsilon$ is called the time of retention of energy in the plasma. The methods and results of measurement of $\tau_\epsilon$ for the Tokamak installation are analyzed. (M.H.R.)

**44874** (MATT-Trans-36) EXPERIMENTS WITH STELLARATOR L-1. Akulina, D. K.; Berezhetskii, M. S.; Batanov, G. M.; Popryadukhin, A. P.; Rabinovich, M. S.; Sbitnikova, I. S.; Shpigel, I. S. (Akademiya Nauk SSSR, Moscow. Institut Fiziki). Translated for Plasma Physics Lab., Princeton Univ., N. J., from the Russian. 35p. (CONF-660717-2). Dep. mn. CFSTI $2.00 cy, $0.50 mn. JCL $3.60 fs, $1.25 mf.

From International Symposium on Experimental and Theoretical Aspects of Toroidal Confinement, Princeton, N. J.

External injection of plasma streams into a closed magnetic container was performed and investigated. The retention of a currentless plasma with helical stellarator fields was studied. (M.H.R.)

**44875** (MATT-Trans-37) TOPOLOGY OF MAGNETIC FIELD AND DIFFUSION OF PLASMA IN TOROIDAL TRAPS. Popryaduhkin, A. (Akademiya Nauk SSSR, Moscow. Institut Fiziki). Translated for Plasma Physics Lab., Princeton Univ., N. J., from the Russian. 29p. (CONF-660717-3). Dep. mn. CFSTI $2.00 cy, $0.50 mn. JCL $2.60 fs, $1.07 mf.

From International Symposium on Experimental and Theoretical Aspects of Toroidal Confinement, Princeton, N. J.

The effects of disturbances of the magnetic field of an "ideal" toroidal trap on plasma diffusion is considered. It is shown that an equilibrium electric field may lead to collisional diffusion of a quiet plasma, even for a zero Larmor particle radius. (auth)

**44876** FREE-MOLECULE LANGMUIR PROBE AND ITS USE IN FLOWFIELD STUDIES. Sonin, Ain A. (Univ. of Toronto). Contracts AF19(628)-363 and Nonr-4073(00). AIAA (Amer. Inst. Aeronaut. Astronaut.) J., 4: 1588-96 (Sept. 1966).

Experiments were performed in a steady, low-density flow of argon plasma to determine the behavior of small cylindrical Langmuir probes in high-speed flows. In particular, the dependence of the ion current on the probe radius and on flow speed was investigated and correlated with the ratio of probe radius to Debye length and the ratio of flow speed to the ion acoustic speed. The probes were then employed to study the electron temperature and number density distributions in the stagnation region of a flat-nosed cylinder in supersonic flow. The Reynolds number $Re_2$, based on model diameter and viscosity at stagnation temperature, was in the range 70 to 125, whereas the Langmuir probes were free molecular. The charged-particle number density distribution measurements provided a graphic demonstration of the merging of the bow shock and the boundary layer at $Re_2 \simeq 100$, and also furnished some evidence of the diffusive separation of the ions and atoms in the shock wave. Nozzle and free-jet flowfields were probed also. (auth)

**44877** VARIABLE COLLISION CROSS-SECTION EFFECTS ON ELECTRICAL CONDUCTIVITY. Shelton, Samuel V.; Carlson, Walter O. (Georgia Inst. of Tech., Atlanta). AIAA (Amer. Inst. Aeronaut. Astronaut.) J., 4: 1676-7(Sept. 1966).

Approximate calculations are presented of the conductivity of a potassium-seeded argon plasma assuming variable collision cross sections and a Maxwell distribution for the electrons. The calculations show that a maximum conductivity exists at a particular current density for each specified combination of gas pressure and temperature. The existence of a maximum for the conductivity as a function of current density guarantees current stability. (W.D.M.)

**44878** STAGNATION POINT LANGMUIR PROBE MEASUREMENTS IN AN ARGON ARC JET. Starner, Keith E. (Aerospace Corp., El Segundo, Calif.). Contract AF 04(695)-469. AIAA (Amer. Inst. Aeronaut. Astronaut.) J., 4: 1685-6(Sept. 1966).

Experimental results obtained with a Langmuir-type probe in an argon arc-jet are presented. An experimental solution to typical probe surface contamination problems is discussed, and the results are compared with expected arc and nozzle operation. (W.D.M.)

**44879** STAGNATION PRESSURE MEASUREMENT IN A CURRENT-CARRYING PLASMA. Barkan, P.; Whitman, A. M. (General Electric Co., Philadelphia). Contract AF33(657)-820651. AIAA (Amer. Inst. Aeronaut. Astronaut.) J., 4: 1691-3(Sept. 1966).

A means is described for measuring stagnation pressures and hence Mach numbers in high density, high current plasmas. The device employs a small, uncooled, expendable pitot tube designed for minimum response time which is rapidly swept through the plasma flowfield. Such a probe offers the advantages of frequency resolution up to the order of 1000 cps, a tolerance for extremely hostile thermal environments ($>10^4$ cal/cm$^3$-sec.), simplicity, and low cost. (W.D.M.)

**44880** RELATIVISTIC GARDENHOSE INSTABILITY. Lerche, I. (Univ. of Chicago). Astrophys. J., 145: 806-10(Sept. 1966).

For an anisotropic, spatially uniform, relativistic plasma imbedded in an infinite, homogeneous magnetic field, the criterion for the existence of the "gardenhose" instability is discussed in the low-frequency, long-wavelength limit. It is shown that this condition can be written $4\pi(P_{||} - P_{\perp}) > H_0^2$, where $P_{||}$ and $P_{\perp}$ are the pressure components of the plasma in directions parallel and perpendicular to the ambient magnetic field, of strength $H_0$. If more than one species of particle is present it is shown that $P_{||}$ and $P_{\perp}$ are the total pressure components due to all species. In the case of a weakly relativistic plasma, the low-frequency, finite-wavelength condition for the existence of the gardenhose instability developed by Noerdlinger is shown to be incorrect and the correct condition is given. (auth)

**44881** DYNAMICAL STATE OF THE INTERSTELLAR GAS AND FIELD. Parker, E. N. (Univ. of Chicago). Astrophys. J., 145: 811-33(Sept. 1966).

There is now enough observational information available to show that the interstellar magnetic field in the general neighborhood of the sun is, on the average, parallel to the plane of the galaxy, with an average strength somewhere between $10^{-6}$ and $10^{-5}$ gauss. Certain dynamical requirements are pointed out for the existence of such a field. They are based on the assumption that the intergalactic medium, whatever it may be, exerts pressures on the galaxy that are small compared to $10^{-12}$ dyne/cm$^2$. It can then be shown that the galactic, or interstellar, magnetic field must be confined to the galaxy by the weight of the gas threaded by the field and distributed throughout the disk of the galaxy. It is then shown that the interstellar gas-field system is subject to a universal Rayleigh-Taylor instability of such a nature that the interstellar gas tends to concentrate into pockets suspended in the field. The cause of the instability may be thought of as a hydromagnetic self-attraction in the interstellar gas, which may be ten times larger than the gravitational self-attraction of the gas. It is this hydromagnetic self-attraction which produces the observed tendency of the interstellar gas to be confined in discrete clouds. (auth)

**44882** NONLINEAR THEORY OF DECELERATION AND THERMALIZATION OF ELECTRON BEAMS IN

PASSAGE THROUGH A PLASMA. Leven, Ronald (Univ., Greifswald, Ger.). Beitr. Plasmaphys., 6: 9-26(1966). (In German).

The effect of the deceleration and thermalization of an electron beam in passage through a plasma, known under the designation of Langmuir paradox, was investigated on the basis of the theory of plasma oscillations. Under the assumption of weak nonlinearity the distribution function $\underline{f}$ of the electrons of the system and the electrical field strength E was developed in series by harmonics, and the slow variation of the nonoscillating part $f_0$ of the distribution function caused by the electron oscillations was determined. By transition of the distribution function $f_0$ to the cumulants $\underline{k}_n$ the partial differential equation which describes the variation of $f_0$ decays into a system of common differential equations for the $\underline{k}_n$. Therefore in limitation to not too large a number of cumulants, the numerical determination of the pattern of $f_0$ and E is possible without excessive labor. From the equations for the variations of the first two cumulants it results that (at least in the region where the distribution functions for the electrons in plasma and beam have an approximately Gaussian character) the electron temperatures in the plasma and beam increase in the presence of plasma oscillations whereas the mean directed velocity of the beam electrons decreases. The numerical calculations show that this process, under given optimum conditions, proceeds rapidly enough to explain the beam thermalization observed in gas discharges. The calculations are based on the model of a collision-free, lateral, and quasineutral electron plasma greatly expanded infinitely in the beam direction with immobile ion background. (tr-auth)

**44883** CONTINUOUS THERMAL RADIO EMISSION OF A PLASMA LAYER IN THE REGION OF THE PLASMA FREQUENCY. Hirth, W.; Wallis, G. (Heinrich-Hertz-Institut der DAW, Berlin). Beitr. Plasmaphys., 6: 28-38 (1966). (In German).

The thermal radiofrequency spectrum of a plasma without external magnetic fields is generally not monotonous in the region of the maximum plasma frequency but possesses under certain conditions a sharp maximum. The occurrence of such a maximum depends first on the type of limitation from the exterior (inhomogeneous boundary region with monotonous density decrease or density discontinuity) and secondly on the total layer thickness, the temperature, and the electron density in the interior of the layer. The determination of the emission capacity was made with wave optical methods in the vicinity of the maximum plasma frequency and above this frequency with beam optical methods. First crude assumptions were made for the magnitude and band width of the maximum in a one-dimensional hydrogen plasma. (tr-auth)

**44884** TIME DEPENDENCE OF INTENSITIES OF $N_2$ $(C^3\pi - \beta^3\pi)$-BANDS IN PULSED FLARE DISCHARGES. Janca, J. (Purkyne-Univ., Brno). Beitr. Plasmaphys., 6: 39-43(1966). (In German).

In the nucleus of pulsing flare discharges, the intensities of the $N_2$ bands excited by electron collisions are dependent on the electrical field strength. The electric field intensity in the nucleus of the flare depends strongly on the temperature of the neutral gas. The time pattern of the intensities of the $N_2$ bands vary with the pressure at which the flare burns. The excitation process in the nucleus of the pulsing flare discharge can be affected by suitable pulse excitation. The use of pulsing flare discharges is promising as a spectral analytical light source. (tr-auth)

**44885** PLASMA DIAGNOSTICS FROM RAY DISPLACEMENT DURING THE REFLECTION OF LINEAR OR ELLIPTICALLY POLARIZED WAVES UNDER CONSIDERATION OF THE CONDUCTIVITY OF THE INCIDENT MEDIUM. Schilling, Heinz (Technische Hochschule Otto von Guericke, Magdeburg, Ger.). Beitr. Plasmaphys., 6: 45-58(1966). (In German).

The maximum of the beam displacement parallel to the incident plane was determined principally by the difference of the dielectric loss. When these are approximately equal, an exaggerated maximum and a reduced angular and frequency width, in comparison with the effect in nonabsorbing incident medium, are observed. In the reflection of a sharply bundled beam of scattered frequency, an image spot is obtained whose expansion is larger and whose intensity is weaker than in nonconducting incident medium. The displacement depends also on the degree of polarization. For the diagnosis of an homogenous isotropic plasma important additions to the formula $\epsilon_a^1 = \epsilon_a + i\,\sigma_a/\omega = \epsilon_0\,(k_{ra} + ik_{ia})$ appear on these bases. Larger values of the displacement orthogonally to the incident plane occur only when the sending frequency is slightly over the plasma frequency. They are limited to one very small region of small incident angles. (tr-auth)

**44886** NOZZLE CURRENT OF A HYPERSONIC ARGON PLASMA JET. Boldt, Werner (Physikalisch-Technisches Institut der DAW, Berlin). Beitr. Plasmaphys., 6: 59-72(1966). (In German).

Investigations of the nozzle current of a hypersonic argon plasma jet are reported. The plasma jet flows in a low pressure receptacle at 7 torr a so-called thermal nozzle in which the subcritical region served as a cylindrical thermal nozzle and the supercritical region as a diverging Lavall nozzle was used as the supersonic nozzle. The Reynolds number of the plasma jet at the nozzle output is significantly under the critical value. The nozzle flow is therefore still laminar. By an evaluation it can be shown that in the supersonic nozzle an equilibrium flow is present. The power balance of the plasma jet shows good agreement between the theoretically expected and the spectroscopically measured temperature distribution which indicates the validity of the extrapolated temperature profile in the boundary zone. (tr-auth)

**44887** RESONANT FREQUENCIES OF A REACTIVE STRUCTURE COUPLED TO A WARM PLASMA. Anicin, B. A. (Univ. of Sheffield, Eng.). Brit. J. Appl. Phys., 17: 1117-25(Sept. 1966).

The resonant frequencies of a vhf Lecher line coupled to a mercury arc plasma via a split-cylinder coupler were measured as a function of electron density. Two strong resonances were found for every value of electron density. The higher frequency resonance may be described as circuit resonance perturbed by the plasma, the lower one as plasma resonance influenced by the circuit. Cold plasma theory predicts qualitatively many of the observed properties of these resonances, including the appearance of upper and lower frequencies. It also predicts a forbidden frequency gap between the lower and upper frequency curves. It fails to predict the behavior of the lower branch curves near their horizontal asymptote. Experimentally the curves approach this asymptote from above, whereas cold plasma theory predicts that the asymptote should be approached from below. Since the average transit time of thermal electrons is comparable with the period of the vhf oscillations in this experiment, the results were compared with warm plasma theory. It was found that warm plasma theory gives the correct behavior near the lower branch asymptotes, and compares well with the experimentally measured resonant frequencies. (auth)

**44888** NOTE ON THE SINGLET AND TRIPLET POPULATION IN HELIUM. Mewe, R. (FOM-Instituut voor Plasma-Fysica, Jutphaas, Netherlands). Brit. J. Appl. Phys., 17: 1239-40(Sept. 1966).

Comparison of various results for singlet and triplet populations in helium shows that methods of determining electron temperatures in helium plasmas from optical excitation cross sections are unlikely to be reliable except at electron densities below a critical density. Results of calculations for the solar chromosphere, which yield a triplet over-population compared with other results, are also discussed. (auth)

**44889** ION RESONANCE IN WEAKLY IONIZED GAS. Stoichev, T.; Zhelyazkov, I. (Sofia Univ.). Compt Rend. Acad. Bulg. Sci., 19: 349-52(1966).

The interaction between a weakly ionized plasma cylinder and electromagnetic fields with frequencies from 1 to 10

Mc/s is studied on the assumption that the behavior of the plasma ions will be essential. The plasma is produced in a hot-cathode cylindrical tube with an inner diameter d = 0.8 cm, filled with noble gases: He, Ne, Ar, and Kr at pressures from $10^{-2}$ to 1 torr. The experiments show a resonance change of the Q-factor of the circuit by the discharge tube current. It was established in all experiments that the type of the exciting device has no influence on the dependence of the resonance current on the frequency—the resonances are most pronounced with the indicated configuration. Under the conditions selected for the experiment, no oscillations of the plasma are observed above the noise level. (M.H.R.)

**44890** CORRECTION TO THE CALCULATION OF THE CURVATURE OF THE SHOCK WAVE IN A SHOCK TUBE WITH CIRCULAR CROSS SECTION. Rieutord, Emile; Gruat, Jean (Institut National des Sciences Appliquees, Lyon). Compt. Rend., Ser. A, 263: 253-6 (Aug. 8, 1966). (In French).

The results of a calculation of the curvature of the shock wave for a shock tube with circular cross section are presented. The method used allowed for a representation of the limiting layers excluding the anomaly of a surface wave tangent to the wall. A better agreement with the experimental values is thus obtained. (tr-auth)

**44891** OPERATION OF PLASMA ACCELERATORS USING PROGRESSIVE WAVES. Fabri, Jean; Moulin, Thiebaut; Paulon, Jacques; Charpenel, Marc (National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux, France). Compt. Rend., Ser. B, 263: 234-6 (July 18, 1966). (In French).

A very simple experiment is described which shows the role of the electromagnetic forces in plasma acceleration and relegates to a secondary level the effects of thermal acceleration. (tr-auth)

**44892** PARAMAGNETIC AMPLIFICATION OF A BEAM PLASMA SYSTEM. Pham Tu Manh (Univ., Paris, Orsay, France). Compt. Rend., Ser. B, 263: 435-8(Aug. 8, 1966). (In French).

A neutral gas was ionized by an electron beam to create the plasma in a system similar to the one that yielded the classical amplification by coupling the beam-plasma modes in the band from 1 to 3.5 GHz with net gains of the order of 30 db. The same input and output coupling coils were used. These coils consisted of concentric helices approximately 50 mm long and spiraled in an inverse sense. The coils are placed at each end of a 70-mm cylindrical cavity which is bounded by plane metallic terminals. A movable probe measures the electric components of the field in the cavity. An h-f pumping signal is injected into the input coupling coil at the same time as the signal to be amplified which is much more feeble. The output signal is transmitted through the output coil into a spectral analyzer. When the pumping frequency was varied and all other parameters were held constant, a periodic variation of the gain was observed. But when the signal frequency was changed while holding constant the pumping frequency, a peak was obtained at a signal frequency approximately twice as large as the pumping frequency. No explanation has been yet proposed to explain the mechanism of this amplification. (G.O.Y.)

**44893** ALLOWED BANDS FOR WAVE GENERATION THROUGH NONLINEAR EFFECTS IN A PLASMA. Cano, Renato; Etievant, Claude; Fidone, Ignazio; Mattioli, Mario; Olivain, Jack; Perulli, Mariano (EURATOM-CEA, Fontenay-aux-Roses, France). Compt. Rend., Ser. B, 263: 439-42(Aug. 8, 1966). (In French).

The generation of waves by nonlinear effects was observed in a plasma in a strong magnetic field ($\omega_p \ll \omega_{ce}$). The frequencies generated satisfy the selection rule $\omega_1 + \omega_2 = \omega_3$, and are located in the frequency bands allowed by the linear dispersion relation. (tr-auth)

**44894** QUASILINEAR THEORY OF TWO-STREAM CYCLOTRON INSTABILITY OF ELECTRON BEAMS. Kopecky, V.; Preihaelter, J.; Vaclavik, J. (Inst. of Plasma Physics, Prague). Czech. J. Phys., 16: 767-73 (1966).

A study is presented of cyclotron instability ($\omega \approx \Omega_e$) of two opposite beams of electrons from the aspect of the quasilinear effects. For this case of instability the diffusion equation in the velocity space for an averaged distribution function is evolved. The relaxation times of the spreading of the distribution function in the velocity space are estimated. Results are compared with an experiment described by M. Seidl and P. Sonka [Phys. Letters 11: 31(1964)]. (auth)

**44895** RESONANCE STATE FOR THE INDUCTION ACCELERATION OF A CYLINDRICAL PLASMA CLUSTER. Novak, B. (Czech Technical Univ., Prague). Czech. J. Phys., 16: 774-81(1966).

The resonance conditions for maximum attainable velocity of a cylindrical plasma cluster (theta pinch) were found by solving magnetohydrodynamic equations. A relation is given for the maximum kinetic energy which the cylindrical cluster can obtain from the external discharging circuit. Calculation was performed on a computing machine. (auth)

**44896** MEASUREMENT OF RADIAL DISTRIBUTION OF ELECTRON DENSITY IN PLASMA CYLINDER WITH MULTIBEAM MICROWAVE INTERFEROMETER. Musil, J. (Inst. of Plasma Physics, Prague). Czech. J. Phys., 16: 782-90(1966).

The measurement of the radial distribution of electron density N(r) in a plasma cylinder was made with the aid of a multibeam microwave interferometer. The properties of focused beams and the demands on the interferometer are analyzed, and a method is described by which one can compute the radial distribution of electron density N(r) from the measured values. A curve of N(r) experimentally determined with the aid of a four-beam 8 mm interferometer is compared with that obtained by Langmuir probe measurements. The shape of the curve ascertained with the microwave technique, is in very good agreement with that of probe measurements. The difference in absolute values of the measured densities is less than 50%. (auth)

**44897** ELECTROMAGNETIC-FIELD SOLUTION OF A DIFFUSE PLASMA BOUNDARY. Hasserjian, G. (Boeing Co., Seattle, Wash.). Electron. Lett., 2: 303(Aug. 1966).

An exact wave solution is obtained for a transitional plasma region having an Epstein variation for both the electron density and collision frequency. The planewave reflection and transmission coefficients for such a layer are expressed in terms of a correction term multiplying the coefficients, corresponding to a layer of variable electron density but constant collision frequency. (auth)

**44898** RAY-THEORY INTERPRETATION OF REFLECTION OF RADIO WAVES BY A LINEARLY GRADED PLASMA. Cullen, A. L. (Univ. of Sheffield, Eng.). Electron. Lett., 2: 311-12(Aug. 1966).

When a beam of microwaves is incident at an angle $\theta_i$ on a linearly graded plasma, it emerges at a distance D from the point of incidence given by ray theory as $D = 2x_c \sin 2\theta_i$. A more accurate result can be obtained by applying the principle of stationary phase to the reflected angular spectrum of waves, making use of the reflection coefficient, which can be expressed simply in terms of Airy functions when the electric vector is perpendicular to the plane of incidence. This more accurate result can be represented, to a very close approximation, by taking into account a reflection arising from the discontinuity of gradient at the boundary of the plasma and combining this with the geometrical-optics result, which leads to the equation quoted above. The ray-theory interpretation is shown to have practical implications with the oblique-incidence diagnostic technique introduced by Kharadly. (auth)

**44899** COUPLED-WAVE EQUATIONS FOR PROPAGATION IN STRATIFIED COMPRESSIBLE MAGNETOPLASMAS. Burman, R. (Victoria Univ., Wellington, New Zealand). Electron. Lett., 2: 352-4(Sept. 1966).

The propagation is described for coupled electromagnetic and electroacoustic waves in a magnetized compressible continuously stratified electron plasma. Some first-order coupled-wave equations are derived. (auth)

**44900** PRODUCTION OF STATIONARY PLASMA BEAMS BY MEANS OF A GLOW DISCHARGE AT NORMAL PRESSURES. **Irmer, J.; Gelfort, E.** (Deutsche Akademie der Wissenschaften, Berlin). **Exp. Tech. Phys., 13: 426-9(1965). (In German).**

An apparatus is described with which luminescent plasma beams can be produced by means of gas flowing through a glow discharge at low pressure. Under the research conditions given discharges can be maintained at not too high current intensities (less than 15 amp) for times up to an hour. It is shown that such plasma beams are of interest not only from the physical aspects but also in the production of special chemical reactions in the area of plasma chemistry. (tr-auth)

**44901** CONCERNING LOSSY, COMPRESSIBLE, MAGNETO-IONIC MEDIA: GENERAL FORMULATION AND EQUATION DECOUPLING. **Chen, H. H. C.; Cheng, D. K.** (Syracuse Univ., N. Y.). **IEEE (Inst. Elec. Electron. Eng.) Trans. Antennas Propagation, AP-14: 497-50 (July 1966).**

A general formulation for electromagnetic problems in unbounded, lossy, compressible, magneto-ionic media is presented. The governing equations are made concise by the introduction of a compressivity tensor which can be considered as a new constitutive parameter characterizing the effect of medium compressibility. The matrix forms of both the permittivity tensor and the compressivity tensor are given. From the new governing equations, a three-dimensional vector wave equation and a dispersion relation for a uniform plane wave are derived. The vector wave equation is convenient to use in solving radiation problems by the construction of an appropriate dyadic Green's function. Alternatively, simultaneously scalar wave equations in the longitudinal components of the electromagnetic field and in the pressure distribution can be written through a partitioning of the permittivity and compressivity matrices. These equations can be decoupled in the lossless case by a transformation of variables. Both the required transformation matrix and the resulting uncoupled, second-order, differential equations are given. Formulas for the determination of the transverse components of the electromagnetic field have also been derived. (BBB)

**44902** SEQUEL TO "RECIPROCITY RELATIONS IN A COMPRESSIBLE PLASMA". **Cheng, D. K.; Chen, H. C.** (Syracuse Univ., N. Y.). **IEEE (Inst. Elec. Electron. Eng.), Trans. Antennas Propagation, AP-14: 519(July 1966).**

Recently the authors discussed the reciprocity relations in a compressible plasma (Trans. Antennas Propagation, AP-13: 989-90(Nov. 1965)). Acknowledgment is now made of some related work done by Samaddar, of which the authors were not aware when the earlier communication was written. A reciprocity relation for an anisotropic compressible plasma under a source-free situation was derived by him. Originally it was stated that the reciprocity relation would be satisfied in an unbounded region or when the region was covered by a perfect conductor. These conditions could be relaxed to include the more general boundary conditions: $\hat{n} \times \overline{E}_{1\cdot 2} = \overline{\overline{Z}} \cdot \overline{H}_{1\cdot 2}$ and $\hat{n} \cdot \overline{v}_{1\cdot 2} = Yp_{1\cdot 2}$ where $\overline{\overline{Z}}$ is an impedance dyadic which may be a function of the position on the boundary and Y is a scalar admittance function. It is also noted that the more general reciprocity relation holds without having to require that the divergences of $\overline{J}_{e1}$ and $\overline{J}_{e2}$ vanish. (BBB)

**44903** QUASI-TE$_{11}$ MODES IN AN ANISOTROPIC PLASMA WAVEGUIDE. **Carlile, R. N.** (Univ. of Arizona, Tucson). **IEEE (Inst. Elec. Electron. Eng.) Trans. Microwave Theory Tech., MTT-14: 350-1(July 1966).**

A simple technique for measuring the propagation constants of the quasi-TE$_{11}$ modes in a cylindrical waveguide partially filled with an anisotropic plasma is demonstrated. A cross section of the system investigated is shown. Measurements were made of the propagation constants of the quasi-TE$_{11}^{+}$ (the mode which rotates with a right-handed sense with respect to the direction of the d-c magnetic field) and quasi-TE$_{11}^{-}$ (the mode which rotates with a left-handed sense) modes. These resonances are referred to as TE$_{11m}^{+}$ and TE$_{11m}^{-}$. The propagation constants were measured as a function of frequency by constructing a resonant system and then causing it to resonate in the TE$_{11m}^{+}$ or TE$_{11m}^{-}$ mode at a large number of frequencies. It was demonstrated that the propagation constants of the quasi-TE$_{11}^{+}$ and quasi-TE$_{11}^{-}$ modes may be found with good accuracy by measuring positions of field nodes of resonances derived from these modes. It is also shown that the TE$_{11m}^{+}$ and TE$_{11m}^{-}$ resonances do exist and can be excited easily, at least when the plasma is the positive column of a mercury vapor discharge. (BBB)

**44904** DIELECTRIC FUNCTION OF A DEGENERATE ELECTRON GAS IN THE PRESENCE OF A STEADY MAGNETIC FIELD. **Misra, P.** (Ravenshaw Coll., Cuttack, India). **Indian J. Phys., 40: 253-7(May 1966).**

Using the Boltzmann–Vlasov equation, expressions were derived for the frequency and wave-number dependent dielectric function of a degenerate electron gas in the presence of a steady magnetic field. They are valid at and near absolute zero temperatures. (auth)

**44905** NONSTATIONARY MAGNETIC FIELD DIFFUSION INTO PLASMA COOLED BY SOLID WALLS. **Sinaiskii, E. G.; Shakhov, E. M. Izv. Akad. Nauk SSSR, Mekh. Zhidkosti Gaza, No. 4, 3-8(July-Aug. 1966). (In Russian).**

The heat conductance during magnetic field diffusion into plasma was evaluated, and a method of integral correlations was developed for the rate of magnetic field diffusion into plasma cooled by solid walls. The method holds good only in the case of thin thermal and diffusion layers. (R.V.J.)

**44906** LOW-FREQUENCY OSCILLATIONS IN A THERMAL CESIUM PLASMA. **Decker, John A. Jr.** (Sperry Rand Research Center, Sudbury, Mass.). **J. Appl. Phys., 37: 3701-6(Sept. 1966).**

The oscillation modes present in the "TOPSY" thermally generated cesium plasma device were investigated experimentally; oscillation frequency spectra and three-axis $(r,\theta,z)$ maps of relative phase were studied as functions of axial magnetic field strength, electron density, axial drift current, plasma column length, and ionizer sheath polarity. Both conducting and nonconducting cold end plates were used. Two distinct modes were observed: a low-frequency oscillation (~1 kHz) identified as an ion acoustic wave excited by axial circulating in the periphery of the plasma column, and a higher-frequency oscillation (7 to 50 kHz) whose frequency behavior showed close agreement with the theory of the "universal" resistive drift-wave instability, but which failed to show the azimuthal propagation predicted by this theory. The lack of observed azimuthal phase shift could not be explained in terms of the transit-time-controlled potential-relaxation oscillations predicted for thermally generated plasmas, by sheath oscillations, or by the reflection of the drift waves at the plasma end plate sheaths. Both modes were spontaneously present in the "quiescent" plasma (i.e., with no net drift current) and were neither further excited nor significantly altered in the presence of strong drift currents. (auth)

**44907** EXACT SOLUTION FOR THE EIGENFREQUENCIES OF A MICROWAVE CAVITY PARTIALLY FILLED WITH A MAGNETIZED PLASMA. **Shohet, J. L.** (Princeton Univ., N. J.). **J. Appl. Phys., 37: 3775-8 (Sept. 1966). (MATT-390).**

Pure TE and TM waves do not, in general, exist in a microwave cavity partially filled with a magnetized plasma. The scalar wave equations are coupled (the equation for $E_z$ has a term involving $H_z$ and vice versa). Uncoupling of the two equations results in two fourth-order wave equations, which are biquadratic. The solution of this equation can be obtained by factoring the fourth-order expression into the product of two second-order wave equations. The result is two solutions for $E_z$ and $H_z$. From these terms, all other field components may be found. A set of six boundary conditions on the field components gives a determinantal expression for the eigenvalues. These can be presented in mode chart form and show the splitting of degenerate modes along with resonances at the electron-cyclotron frequency. The technique is applicable to any form of the dielectric tensor if it can be specified in complex notation. (auth)

**44908** ENHANCEMENT OF ACOUSTIC-ELECTROMAGNETIC WAVE COUPLING ACROSS A PLASMA-AIR BOUNDARY. **Jull, E. V. (Radio and Electrical Engineering Div., Ottawa); Hedvall, P. J. Appl. Phys., 37: 3835-40(Sept. 1966).**

The linearized field equations for ion acoustic and electromagnetic waves in a low-pressure gas discharge or semiconductor are considered. Boundary conditions at a density discontinuity and a plasma-air surface are examined and expressions are derived for the reflected and transmitted fields excited by an incident acoustic wave. Numerical results for the power transmission through a plasma-air boundary indicate that great enhancement can be obtained in a narrow frequency range by a boundary layer of reduced density and a thickness of an odd multiple of the acoustic half-wavelength. (auth)

**44909** NEGATIVE BIAS PROBE FOR HIGH-DENSITY PLASMA STUDY. **Rohatgi, Vijay K. (Space Sciences Inc., Waltham, Mass.). J. Appl. Phys., 37: 3911-13 (Sept. 1966).**

Results of experiments made with a negatively biased probe in Ar and He plasmas with electron densities of the order of $10^{15}$ electrons/cc are described. Probes of Cu, Ni, Mo, and W were used. The probe current was measured as a function of the applied voltage keeping the gas flow rate and the main arc current constant. Data reported were taken at one atm with 0.1 g/sec flow of Ar and 0.02 g/sec flow of He and at arc currents of 50 to 200 amp. Starting with zero bias voltage, the current increased exponentially at first and then linearly at 10 to 50 v. At higher voltages the current jumped suddenly to a high value and the voltage dropped. The probe characteristic was found to be independent of the probe material but dependent on the test gas and the main arc current. Empirically, the current-voltage curve at a given main arc current can be described by a relation of the form $i = i_0 [1 - \exp(-\beta V)] + \sigma V$ where $i_0$, $\beta$, and $\sigma$ are constants. (A.G.W.)

**44910** MONTE CARLO STUDY OF A ONE-COMPONENT PLASMA. [PART] I. **Brush, S. G. (Univ. of California, Livermore); Sahlin, H. L.; Teller, E. Contract W-7405-eng-48. J. Chem. Phys., 45: 2102-21 (Sept. 15, 1966). (UCRL-14467-T(Rev.1)).**

A Monte Carlo study was made of a plasma of heavy ions immersed in a uniform neutralizing background. Systems containing from 32 to 500 particles, with periodic boundary conditions, were used. The results of the study are presented in terms of a dimensionless parameter $\Gamma = (4\pi n/3)^{1/3} [(Ze)^2/kT]$, where n is the ion density (particles per cubic centimeter), T is the temperature (degrees Kelvin), k is the Boltzmann constant, e is the electronic charge, and Z is the atomic number. Thermodynamic properties and pair distribution functions were obtained for values of Γ ranging from 0.05 to 100.0 from the canonical ensemble by the Monte Carlo (MC) method. Two different methods were used to determine the potential energy of a configuration. The first is the minimum-image convention employed in many previous MC calculations. Each particle is allowed to interact only with each other particle in the basic cell, or with the nearest periodic image of each other particle if the image is closer. In the second method, the interaction of a particle with all the images of the other particles, and with the uniform background is taken into account by a technique similar to the Ewald procedure used to calculate lattice sums. It is found that both methods of determining the potential energy yield essentially the same results for the pair distribution function g for Γ values of 10 or less. For larger values of Γ the results given by the two methods differ significantly, indicating that the minimum image convention is inadequate for plasma systems at high densities and low temperatures. Energies and values of the pair distribution function are compared with predictions of various approximate theories for small Γ values. It is found that the nonlinear Debye–Hückel (DH) theory is in agreement with the MC results for values of Γ up to 0.1. At Γ = 1.0, significant deviations from the DH theory are observed. For Γ = 1.0, g is found to be in close agreement with Carley's calculations based on the Percus–Yevick equation. For values of Γ above 2, g is no longer a monotonic function of the interparticle distance r, but begins to show oscillations characteristic to latticelike structures. For large values of Γ these oscillations are quite pronounced. The system is observed to undergo a fluid–solid phase transition in the vicinity of Γ = 125. (auth)

**44911** TEMPERATURES OF NEUTRAL ATOMS IN C-STELLARATOR DISCHARGES AND CHARGED-PARTICLE TEMPERATURES OF THE AFTERGLOWS. **Hirschberg, Joseph G.; Hinnov, Einar (Princeton Univ., N. J.). J. Chem. Phys., 45: 2233-9(Sept. 15, 1966). (MATT-426).**

The kinetic temperatures of neutral helium and hydrogen atoms in ohmically heated discharges of the C stellarator were determined from measurements of spectral profiles of the λ4921, $2^1P-4^1D$ line of HeI and the $H_\beta$ line of hydrogen. The time resolution of the measurements was about 250 μsec, or about $1/10$ of the duration of the discharge. It was found that the neutral atoms were at all times at a temperature much higher than the walls of the discharge vessel, with highest temperatures in the neighborhood of 2 ev. The results are interpreted in terms of energy transfer between electrons and ions through Coulomb collisions, between ions and neutral atoms through resonant charge exchange, and between neutral atoms and the walls through semielastic collisions. In addition, the temperature of the recombining ions in the afterglow of the discharges was determined by the same method, and found to be in good agreement with simultaneously measured electron temperatures. (auth)

**44912** FIELD BOUNDARY OF TWO LINE CURRENTS IMMERSED IN A STREAMING PLASMA. **Sozou, C. (Northampton Coll. of Advanced Tech., London); Loizou, G. J. Fluid. Mech., 25: 761-8(Aug. 1966).**

The cavity in which the magnetic field of two arbitrary line currents is confined by a streaming plasma which is assumed cold and perfectly conducting is investigated by using conformal transformations. When the magnetic field at the boundary is always directed in the same sense the finite breadth of the cavity at infinity depends only on the algebraic sum of the inducing currents and not their position. If the two line currents are of opposite sign the boundary magnetic field may change sign at two "pseudo-singularities." (auth)

**44913** DEGENERACY OF CYCLOTRON MOTION. **Dulock, Victor A.; McIntosh, Harold V. (Univ. of Florida, Gainesville). J. Math. Phys. (N. Y.), 7: 1401-12(Aug. 1966).**

The classical problem of planar cyclotron motion of a charged particle in a uniform magnetic field possesses symmetries which account for the "accidental" degeneracies of the analogous nonrelativistic Schrödinger equation, as found by Johnson and Lippman. The essentially quadratic nature of the Hamiltonian is not changed by considering the particle moving in a harmonic oscillator potential, a "Zeeman effect" for the harmonic oscillator. The transitions to the limiting cases of a weak magnetic field (pure harmonic oscillator) or a strong field (pure cyclotron motion) involve the contraction of the corresponding symmetry groups, yielding Larmor precession of the oscillator orbits in the first case, and the drift of the cyclotron orbit in the second. The constants of the motion generate the unitary unimodular group SU(2) in all cases except for pure cyclotron motion, in which case one obtains the commutation rules of creation and annihilation operators. Only for certain ratios of magnetic field strength to the oscillator frequency does one obtain bounded closed orbits, and presumably only in these cases do degeneracies exist quantum-mechanically. A transition to a rotating coordinate system reduces the problem to that of a plane harmonic oscillator; however, the time dependencies of the transformation must be allowed for interpreting the constants thereby arising. Moreover, the velocity-dependent forces introduce gauge transformations which also affect the interpretation of the symmetries. There are two kinds of symmetries—inner symmetries involving the canonical coordinates and governing the shape of the orbits, and outer symmetries involving the mechanical coordinates and governing the location of the orbits. (auth)

**44914** GENERAL SPHERICAL HARMONIC TENSORS IN THE BOLTZMANN EQUATION. Johnston, Tudor Wyatt (RCA Victor Co., Ltd., Montreal). J. Math. Phys. (N. Y.), 7: 1453-8(Aug. 1966).

The irreducible velocity space direction cosine tensors associated with velocity magnitude spherical harmonic expansion of the distribution function are manipulated in the Boltzmann–Vlasov flow terms to yield a linked chain of equations whose general (lth) equation is given explicitly. This generalizes earlier results for l = 0, 1, 2, 3. (auth)

**44915** NEW CLUSTER SCHEME IN STATISTICAL PHYSICS. Ramanathan, G. V. (Princeton Univ., N. J.). J. Math. Phys. (N. Y.), 7: 1507-31(Aug. 1966). (MATT-384).

A new cluster scheme is proposed, and some of its advantages over the Mayer expansion method are demonstrated. An explicit equation is derived for the s-particle correlation in a large equilibrium system of particles interacting through a two-body potential. This equation is solved to the leading order in the plasma limit. It is found that, in several systems, the equilibrium s-particle correlation is, to the leading order, a functional of the two-particle correlation, independent of the detailed form of the potential function. (auth)

**44916** DISPERSION RELATION OF A PLASMON IN AN ELECTRON GAS. Yamada, Hideji; Shimizu, Masao (Nagoya Univ., Japan). J. Phys. Soc. Jap., 21: 1517-21 (Aug. 1966).

Within the frame of the random phase approximation, the equation of motion for normal modes in an electron gas is solved by the iteration method and dispersion relations of a plasmon for the paramagnetic and ferromagnetic electron gases are obtained. The dispersion relation in the paramagnetic state agrees with that given by Kanazawa et al. It is shown that there is no difference between the constant terms in the dispersion relation with respect to the momentum of a plasmon in the paramagnetic and ferromagnetic states, but coefficients of the terms proportional to the square of the momentum in the dispersion relation are different in the paramagnetic and ferromagnetic states. This difference is roughly estimated for the real ferromagnetic metals, iron, cobalt and nickel, and a possibility of the observation of this difference is discussed. (auth)

**44917** POSITIVE COLUMN IN A VERY STRONG MAGNETIC FIELD. Sato, Noriyoshi; Saito, Susumu; Nishida, Yasushi; Mase, Hiroshi (Tohoku Univ., Sendai). J. Phys. Soc. Jap., 21: 1606(Aug. 1966).

A positive column of a hot-cathode mercury discharge in a magnetic field stranger than a critical field for helical instability is discussed. The test tubes and the magnetic field configuration are shown. Oscillations are detected with metal leaves placed on the tube wall, as well as at the anode connected to a dual-beam synchroscope and a frequency analyzer. The variations of the discharge-maintaining voltage as a function of the magnetic field are shown. Changes in the diameter of the glowing region of the positive column are indicated, and examples of the waveforms and frequency spectra of the oscillations are included. (J.H.M.)

**44918** NOTE ON LANGMUIR PROBE METHOD FOR A PLASMA HAVING SMALL AMPLITUDE OSCILLATIONS. de Boer, P. C. T. (Cornell Univ., Ithaca, N. Y.). J. Phys. Soc. Jap., 21: 1625(Aug. 1966).

Results were given for the average current collected by a Langmuir probe in the presence of oscillations in the plasma potential [J. Phys. Soc. Japan, 19: 1908(1964)]. Approximate expressions were derived for oscillations with rectangular and sawtooth wave form. Calculations are presented to point out that the approximation used is not very accurate, and that exact results may be obtained without difficulty. (J.H.M.)

**44919** CHARACTERISTICS OF A CYLINDRICAL PROBE IN A LOW-DENSITY PLASMA STREAM. Amemiya, Hiroshi; Dote, Toshihiko (Inst. of Physical and Chemical Research, Yamatomachi Kita-adachigun, Japan). Jap. J. Appl. Phys., 5: 957-61(Oct. 1966).

The positive ion current characteristic of a cylindrical probe in a drifting plasma is presented under the condition that the gas density is so low that the free molecular theory applies and that there is a clear boundary between the plasma and the sheath, the latter form being assumed to be a cylinder coaxial with the probe. For the estimation of the sheath thickness the equation of space-charge-limited currents is applied. The ratio between the ion currents when the axis of the probe is parallel and perpendicular to the direction of the flow is shown to provide a determination of the speed ratio. (auth)

**44920** HIGH-RESOLUTION ECHELLE MONOCHROMATOR AND ITS APPLICATION TO ION TEMPERATURE MEASUREMENT OF He PLASMA. Miyamoto, Kenro (Univ. of Nagoya, Japan); Otsuka, Masamoto; Fujita, Junji; Kawasaki, Sunao; Inoue, Nobuyuki; Suzuki, Yasuo; Uchida, Taijiro; Mori, Kazuo; Ando, Kozo; Ishimura, Tsutomu. Jap. J. Appl. Phys., 5: 970-3(Oct. 1966).

For the measurement of the profile of a spectral line, a high dispersive monochromator with an Echelle grating and 12 channels of photoelectric devices using thin glass sheets to separate the line profile was constructed. The measured resolving power was about $2 \times 10^5$ and the linear dispersion at the image plane was 1.2 mm/Å at 5000Å. This instrument was used to measure the ion temperature of a BSG device by employing the 4686Å line of He II. (auth)

**44921** MEAN ELECTRON ENERGY OF A PLASMA EMERGING FROM A DUOPLASMATRON ION SOURCE. Watanabe, Masanori (Matsuhita Electric Industrial Co., Ltd., Osaka); Suita, Tokuo. Jap. J. Appl. Phys., 5: 975 (Oct. 1966).

It has been reported (Nucl. Instr. and Meth., 10: 263(1961) that the electrons passing through the anode aperture of a duoplasmatron ion source have a mean axial velocity corresponding to an energy of 30 to 100 ev, depending on the magnetic field. The pressure dependence of the mean energy of the electrons passing through the anode aperture is reported. It was found that the energy was 51 ev at a source pressure of 0.06 Torr and decreased to 26 ev at increasing pressure. (W.D.M.)

**44922** A PLASMA ION GUN WITH PIERCE ELECTRODE. Tamura, Hifumi; Kimura, Hirokazu (Hitachi Ltd., Tokyo). Jap. J. Appl. Phys., 5: 985-7(Oct. 1966).

A schematic is shown of an ion gun with the so-called Pierce electrode, which has a simple structure and good efficiency. The ion beam output can be controlled by adjusting the gas pressure, the accelerating voltage, and the distance between the plasma electrode and the accelerating electrode. It is possible to obtain an electron beam by supplying a negative potential on the plasma electrode. Ion and electron currents as a function of extracting voltage are shown. (W.D.M.)

**44923** EFFECT OF ION MOTION ALONG THE MAGNETIC FIELD ON PLASMA STABILITY. Moiseev, S. S. (Novosibirsk State Univ.). JETP Lett. (USSR)(Engl. Transl.), 4: 55-7(Aug. 1, 1966).

Translated from Zh. Eksperim. Teor. Fiz., Pis'ma Redakt., 4: 81-4(Aug. 1, 1966).

The problem is considered neglecting the transverse ion currents, but taking into account the longitudinal ion motion. The hydrodynamic approximation exponential perturbation (curl $\bar{E} = 0$, $\bar{E}$ = electric field of the perturbation) chosen in the form ~ exp $(i\omega t + ik_yY + ik_zz)$ are discussed. (auth)

**44924** SPATIAL AND TEMPORAL CORRELATIONS OF ELECTRIC FIELDS IN A WEAKLY TURBULENT PLASMA. Kornilov, E. A.; Fainberg, Ya. B.; Kovpik, O. F. (Physico-Technical Inst., Academy of Sciences, Ukrainian SSR). JETP Lett. (USSR) (Engl. Transl.), 4: 101-4(Aug. 15, 1966).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Redaktsiyu, 4: 147-52(Aug. 15, 1966).

An investigation was made to determine the spectral energy density $E_k^2$ of the electric field in a weakly turbulent plasma by measuring the spatial autocorrelation functions of the electron fields of h-f oscillations excited in a plasma-beam discharge. The experiment was carried out with an electron beam with energy up to 5 kev and current 20 to 100 mamp, in a magnetic field up to 2,000 G and at $10^{-4}$ mm Hg pressure. (M.O.W.)

**44925** CONSIDERATION ON SOME MEASUREMENTS MADE ON ELECTRIC ARC PLASMA GENERATORS. Alliot, Jean-Marie; Jacquelin, Marc-Henri. pp 111-19 of Journees Internationales de la Combustion et de la Conversion de l'Energie. Paris, Institut Francais des Combustibles et de l'Energie, 1964. (In French).

A plasma generator stabilized by an axial magnetic field is described and the effect of the field on the operation of the generator and on the evolution of pressure and temperatures of the fluid in the jet tube were studied. The principles of the temperature measurement in the jet of plasma generators using spectroscopic methods are recorded for different temperature regions. (J.S.R.)

**44926** INCREASE OF THE TEMPERATURE OF FLAMES BY THE ADDITION OF ELECTRICAL ENERGY. Poncelet, J.; Zettwoog, P. pp 685-98 of Journees Internationales de la Combustion et de la Conversion de l'Energie. Paris, Institut Francais des Combustibles et de l'Energie, 1964. (In French).

The temperature modulations of combustion gases seeded with K were studied using a periodic injection of electrical energy into the gases at a frequency adapted to the procedure. The possibility of augmenting the thermal level of flame by injection of electrical energy is examined in a general fashion. The temperature of normal flames, the addition of electrical energy to the combustion gas, thermal ionization, passage of the current into the conducting gas and its intensity-voltage characteristics, appearance of the arc, and chemi-ionization of gases during combustion are considered. The specific application example of electrical heating of combustion gases seeded with K is briefly considered. (J.S.R.)

**44927** ANTENNA (PROBE) IMPEDANCE AND NOISES IN COSMIC PLASMA. Andronov, A. A. Kosm. Issled., 4: 558-67(July-Aug. 1966). (In Russian).

The impedance of probe models placed in isotropic plasmas was found. It is shown that probe noises in the earth's exosphere and interplanetary space can exceed the intensity of low-frequency cosmic radioemission. The probe model impedance value for plasma frequencies was determined. It is also shown that the active portion of the probe impedance could be negative. (tr-auth)

**44928** CROSS SECTIONS OF ELEMENTARY PROCESSES, REACTION KINETIC CONSIDERATIONS, INVERSION OF TERM POSITION NUMBERS IN WEAKLY IONIZED PLASMAS. Rompe, R. Monatsber. Deut. Akad. Wiss. Berlin, 7: 906-16(1965). (In German).

Examples are given to show that, to a certain extent, data can be obtained from general reaction kinetics considerations when there is no accurate knowledge of the effective cross section and there is uncertainty on the elementary processes present. (J.S.R.)

**44929** PHYSICAL MECHANISM OF THE RADIOFREQUENCY PLASMA. Finzi, U. (Univ., Milan. CNR, Rome). Nuovo Cimento (10), 45B: 45-51(Sept. 11, 1966).

The equilibrium conditions of a radiofrequency-excited plasma subject to a steady magnetic field are discussed. A simple model for the prediction of the equilibrium condition between the absorbed and the dissipated power is proposed. This model is applied to the interpretation of previous experimental observations. A simple resonance phenomenon is thus shown to be the possible basis of the radiofrequency discharge mechanism. (auth)

**44930** ION-WAVE PROPAGATION IN GAS DISCHARGES AT FREQUENCIES HIGHER THAN THE ION PLASMA FREQUENCY. Sessler, G. M. (Bell Telephone Labs., Inc., Murray Hill, N. J.). Phys. Lett., 22: 363-4(Sept. 1, 1966).

Propagation of ion waves in weakly ionized gases was observed at frequencies considerably higher than the ion plasma frequency. Measurements of the phase velocity and attenuation of these waves are compared with theory. (auth)

**44931** STARK WIDTHS OF SINGLY IONIZED ARGON LINES EMITTED BY A PLASMA. Roberts, D. E. (Imperial Coll. of Science and Tech., London). Phys. Lett., 22: 417-19(Sept. 1, 1966).

The Stark-broadened widths of some lines emitted by Ar II were measured. These widths were more than a factor of two larger than the theoretical widths of Griem. A computer program, written to recalculate the widths, partially accounts for the discrepancies. (auth)

**44932** ION ENERGIES IN THE PLASMA PRODUCED BY A HIGH POWER LASER. Fenner, N. C. (Atomic Weapons Research Establishment, Aldermaston, Eng.). Phys. Lett., 22: 421-2(Sept. 1, 1966).

A Q switched ruby laser focused onto a metal foil produces ions with high energy. Ions from different pure foils were found to have the same energy distribution, whereas ions from a composite foil all have the same velocity distribution. (auth)

**44933** ELECTRON DENSITY MAXIMIZATION IN A PENNING GAS MIXTURE IONIZED BY FISSION FRAGMENTS. Leffert, C. B.; Rees, D. B.; Jamerson, F. E. (General Motors Corp., Warren, Mich.). Phys. Lett., 22: 423-4(Sept. 1, 1966).

Theoretical and experimental analyses are presented for the manner in which electron densities ~ $10^{12}$ $cm^{-3}$ vary with total gas pressure and the percentage of trace gas in a Penning mixture ionized by fission fragments. (auth)

**44934** PLASMA DRIFT INSTABILITIES WITH PHASE VELOCITIES BELOW THE ION THERMAL VELOCITY. Porkolab, M. (Stanford Univ., Calif.). Phys. Lett., 22: 427-8(Sept. 1, 1966).

The existence of "drift" plasma instabilities with phase velocities at, and below, the ion thermal velocity is demonstrated. Possible experimental evidence is indicated. (auth)

**44935** DAMPING OF ELECTROSTATIC WAVES IN A SPATIALLY NONUNIFORM PLASMA. Franklin, R. N. (Oxford Univ.). Phys. Lett., 22: 580-1(Sept. 15, 1966).

The method developed by Weissglas for calculating the damping of electrostatic waves in a linear hot bounded plasma was extended and applied to the situation where the electron number density varies significantly. It is concluded that the restriction to real wave numbers does not allow one to estimate accurately the experimentally observed damping. (auth)

**44936** OBSERVATION OF CYCLOTRON ECHOES FROM A HIGHLY IONIZED PLASMA. Kaplan, D. E. (Lockheed Research Lab., Palo Alto, Calif.); Hill, R. M.; Wong, A. Y. Phys. Lett., 22: 585-7(Sept. 15, 1966).

The observation of cyclotron echo phenomena from a highly ionized cesium plasma in a Q-device is reported. The implication of these measurements for a velocity dependent collision frequency mechanism of cyclotron echo formation is discussed. (auth)

**44937** BEAM-PLASMA INSTABILITY IN THE HOLLOW CATHODE DISCHARGE. Popovici, C.; Somesan, M.; Nistor, V. (Inst. of Physics, Bucharest). Phys. Lett., 22: 587-8(Sept. 15, 1966).

A new point of view is suggested that considers the hollow cathode effect as an expression of the plasma instabilities that arise when two antiparallel electronic beams are interacting in the plasma ("double-beam instability"). (auth)

**44938** LIGHT SCATTERING BY PLASMAS. Boyd, T. J. M.; Evans, D. E.; Katzenstein, J. (United Kingdom Atomic Energy Establishment, Abingdon, Eng.). Phys. Lett., 22: 589-91(Sept. 15, 1966).

The assertion of Nguyen Quang Dong that experiments on light scattering in plasmas have invalidated the theory used to interpret them is rejected. In almost all instances the spectrum of scattered light may indeed be characterized by the parameter $\alpha$ defined by Salpeter. (auth)

**44939** NONLINEAR EFFECTS OF BEAM-PLASMA INSTABILITY IN PARTIALLY IONIZED GASES. Cuperman, S. (Israel Atomic Energy Commission, Yavne). Phys. Lett., 22: 591-2(Sept. 15, 1966).

A physical approach to the understanding of the experimentally observed ionization enhancement is suggested, and the mathematical solution is discussed. The case of an infinite beam-plasma system immersed in a strong homogeneous magnetic field ($\omega_p \ll \omega_{ce}$) is treated. (auth)

**44940** SOURCE OF ERROR IN PLASMA ELECTRON OSCILLATION MEASUREMENTS. Emeleus, K. G.; Kennedy, W. T.; Jones, J. M. (Queen's Univ., Belfast). Phys. Lett., 23: 74-5(Oct. 3, 1966).

Plasma ion oscillations, by producing local fluctuations in electron concentration and plasma electron frequency, may cause serious misinterpretation of plasma electron oscillation data, and give fictitious electron wave velocities. (auth)

**44941** HYDROMAGNETIC GRADIENT WAVE. Tolstoy, I. (Hudson Labs. of Columbia Univ., Dobbs Ferry, N. Y.). Phys. Lett., 23: 78-9(Oct. 3, 1966).

A simple hydromagnetic mode of propagation, which exists in the presence of a transverse gradient in a transverse magnetic field, is outlined. Orders of magnitude are given for solid-state plasmas. (auth)

**44942** RADIATION-TEMPERATURE MEASUREMENTS OF THE NITROGEN AFTERGLOW PLASMA. Noon, J. H.; Holt, E. H. (Rensselaer Polytechnic Inst., Troy, N. Y.). Phys. Rev., 150: 121-3(Oct. 7, 1966).

Measurements at microwave frequencies of the radiation temperature of a nitrogen afterglow plasma show that at early postdischarge times a secondary source of electron heating exists, and that microwave conductivity values calculated on the basis of a Maxwellian form for the electron velocity distribution function are anomalous. The evidence points to non-Maxwellian electron velocity distributions in the early afterglow. (auth)

**44943** TEST OF THE THEORY OF STARK BROADENING OF $H_\beta$. Gerardo, J. B.; Hill, R. A. (Sandia Lab., Albuquerque, N. Mex.). Phys. Rev. Lett., 17: 623-6 (Sept. 19, 1966). (SC-DC-66-1890).

Plasma electron densities inferred from the half-intensity width of $H_\beta$ are shown to agree to within ±1.5% with those measured by laser interferometry. (auth)

**44944** PULSED TRANSMISSION AND RINGING PHENOMENA IN A WARM MAGNETOPLASMA. Crawford, F. W.; Harp, R. S.; Mantel, T. D. (Stanford Univ., Calif.). Phys. Rev. Lett., 17: 626-8(Sept. 19, 1966).

An investigation was made of the group velocity of a wave packet propagating radially across a plasma immersed in a static axial magnetic field. The experimental results reproduce in the laboratory a ringing effect, previously observed only in the ionosphere, for which an explanation is given in terms of warm magnetoplasma wave theory. Since the phenomena concerned are only predicted by microscopic theory, the close agreement between experiment and such theory for the observations reported provides a powerful check on its validity. (M.O.W.)

**44945** FLUCTUATIONS IN A PLASMA CONFINED BY A TOROIDAL OCTUPOLE MAGNETIC FIELD. Meade, Dale M. (Univ. of Wisconsin, Madison). Phys. Rev. Lett., 17: 677-9(Sept. 26, 1966).

The stability of a collisionless plasma confined by a toroidal octupole magnetic field was investigated to check the validity of the $\oint dl/B$ stability theory. The experimental technique is outlined. (M.O.W.)

**44946** EXPERIMENTAL OBSERVATION OF DRIFT INSTABILITIES IN TOROIDAL PLASMA. Ohkawa, T.; Yoshikawa, M. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. Lett., 17: 685-8 (Sept. 26, 1966).

An experimental observation of a plasma instability and the subsequent theoretical interpretation of the instability is discussed. The instability is of the type first predicted by Mikhailovskii and later by Shima and Fowler, and Krall and Fowler. It is due to the resonance between the drift wave and the cyclotron wave. (M.O.W.)

**44947** UPPER LIMITS TO COSMIC $\gamma$ RAYS IN THE RANGE 30 TO 500 Mev. Frye, Glenn M. Jr. (Case Inst. of Tech., Cleveland); Smith, Lawrence H. Phys. Rev. Lett., 17: 733-6(Sept. 26, 1966). (COO-818-89).

Upper limits $\sim 10^{-4}$ photon $cm^{-2}$ $sec^{-1}$ for $30 < E_\gamma < 500$ Mev were set for the $\gamma$-ray flux for ten possible $\gamma$-ray sources including the Crab nebula, Cygnus A, and several quasars. The $\gamma$-ray flux in a vertical cone of 30° half-angle at 3.5 mb is $(5.2 \pm 0.5) \times 10^{-3}$ photon $cm^{-2}$ $sec^{-1}$ $sr^{-1}$. (auth)

**44948** STATISTICAL MECHANICS OF GRAVITATIONAL PLASMAS. Prigogine, I.; Severne, G. (Univ. Libre, Brussels). Physica, 32: 1376-96(Aug. 1966).

The general non-Markovian equation of evolution is used to study velocity distribution in a homogeneous gravitational system. The divergence for long distances that this method usually produces does not appear. The equation of evolution, studied using the approximation corresponding to weak coupling, has the following essential properties: it determines a fundamentally non-ergodic behavior, so evidently that the memory of the initial state can produce the persistent effects; nevertheless one can observe a complex mechanism of oscillating relaxation, and with a correction, Chandrasekhar's results are reproduced as a first approximation. (tr-auth)

**44949** THEORY OF COLLISIONAL HEATING OF PLASMA BY MAGNETIC PUMPING. Gerwin, R. (FOM-Instituut voor Plasma-Fysica, Jutphaas, Netherlands). Physica, 32: 1410-28(Aug. 1966).

A plasma subjected to an alternating magnetic field superposed parallel to a steady magnetic field is heated by conversion of organized energy (fed in by the alternating field) into random energy by charged particle collisions. For an alternating field small compared to the steady field (small amplitude pumping), the heating rate predicted by Schlüter, and by Berger and others, is derived here by a different method, and is found to be valid for an arbitrary energy dependence of charged particle collision frequency. For an alternating field whose maximum strength is comparable to (but not larger than) the steady field (large amplitude pumping), formulas previously given by Schlüter for the heating rates in the two cases, pumping frequency much greater than or much less than collision frequency, are derived here by different, more systematic methods. The power absorption by electrons, in a typical laboratory plasma subjected to large amplitude pumping, is estimated with the aid of numerical computations of the heating rate. (auth)

**44950** HYDROMAGNETIC OSCILLATION OF PLASMA. Stepien, Kazimierz. Postepy Astron., 14: 19-48(Mar. 1966). (In Polish).

Review is given of several types of hydromagnetic waves in the plasma embedded in an external magnetic field. First, the simplest case of uniform nonviscous and noncompressible plasma with a uniform magnetic field is discussed. The compressibility and dissipative effects are introduced. A discussion of oscillations of the uniform plasma with nonuniform magnetic field is given. There are two cases: one when the lines of force of the magnetic field are straight but there is a gradient of the magnetic field perpendicular to the vector of the field and second when the lines of force are curved. Plasma with a constant magnetic field and density gradient is also discussed. Finally the effect of the presence of neutral particles on the dissipation of the hydromagnetic waves is shown. (auth)

**44951** TRANSVERSE PROPAGATION OF ELECTROMAGNETIC WAVES IN A CYLINDRICALLY STRATIFIED AXIALLY MAGNETIZED PLASMA. **Burman, R. (Victoria Univ. of Wellington, New Zealand). Quart. J. Mech. Appl. Math., 19: 247-58(May 1966).**

In a planar continuously stratified magnetoplasma the electromagnetic field cannot be separated into two independent parts (corresponding to horizontally and vertically polarized waves), and the problem of finding the field distribution can be reduced to solving a pair of coupled second order ordinary differential equations. On the basis of an earlier study, the propagation of electromagnetic waves in a continuously varying cylindrically stratified magnetoplasma, when the imposed static magnetic field is parallel to the axis of cylindrical symmetry, is considered. The case in which the fields are independent of distance along the axis is examined. A wave equation was derived which describes the propagation of a wave having only an axial component of magnetic field. A method of obtaining exact solutions to the wave equation is presented. Examples are given in which the method is used to obtain some profiles of the elements of the permittivity tensor in the magnetoplasma corresponding to particular exact solutions of the wave equation. (BBB)

**44952** THE EFFECT OF FINITE ION LARMOR RADIUS ON THE PROPAGATION OF MAGNETOACOUSTIC WAVES. **Yajima, Nobuo (Univ. of Nagoya, Japan). Progr. Theoret. Phys. (Kyoto), 36: 1-16(July 1966).**

The modified C.G.L. equation which includes the effect of the finite Larmor radius of the ion is applied to the study of hydromagnetic wave propagation in a collisionless plasma. The dispersion relation is given for a linearized system in which waves propagate in the direction normal to a magnetic field. Then the dispersive effect of the finite ion Larmor radius and the electron inertia are investigated in various cases. A precursor with an oscillatory structure appears in front of the main disturbance due to the former effect, and the latter gives rise to an oscillatory trail following behind. (auth)

**44953** BOUNDARY CONDITIONS FOR A UNIQUE SOLUTION TO THE LINEARIZED WARM-PLASMA EQUATIONS. **Sancer, Maurice I. (Polytechnic Inst. of Brooklyn, Farmingdale, N. Y.). Contract NONR 839(38). Radio Sci., 1: 1067-72(Sept. 1966).**

A criterion is presented to decide whether a given set of boundary conditions guarantees a unique solution to the linearized warm-plasma equations, and a set of boundary conditions is given which meets this criterion. The boundary conditions often employed when the plasma is contained in a perfectly conducting rigid cavity are shown to belong to this set. An absorptive boundary condition based on sheath considerations is also shown to belong to this set. (auth)

**44954** NONLINEAR INTERACTION OF A NUMBER OF ELECTROMAGNETIC WAVES IN A MAGNETOPLASMA. **Kaw, Predhiman Krishan (Indian Inst. of Tech., New Delhi). Radio Sci., 1: 1089-91(Sept. 1966).**

Following the earlier treatments of Sodha and Palumbo, the mutual nonlinear interaction of a number of electromagnetic waves in a magnetoplasma was investigated. For simplicity in mathematical analysis, all the waves were assumed to be moving in the same direction, viz, the direction of the magnetic field. The interesting phenomenon of resonances is discussed in detail. (auth)

**44955** THERMODYNAMIC PROPERTIES OF AN ELECTRON PLASMA. **Lie, T. J.; Ichikawa, Yoshi H. (Univ. of Illinois, Urbana). Contract DA-28-043-AMC-00073(E). Rev. Mod. Phys., 38: 680-9(Oct. 1966).**

The thermodynamic properties of an electron plasma were investigated on the basis of the Bogoliubov-Born-Green-Kirkwood-Yvon hierarchy equation. The correlation energy was calculated up to the $\epsilon^2$ term ($\epsilon$ is the standard plasma parameter) in terms of an exact solution of the binary correlation function taking into account the short-range collision effect. The contribution of ternary correlations to the correlation energy was determined in lowest order, which turned out to be of the second order in $\epsilon$. The total sum of the corrections due to the short-range collision effect and the ternary correlation effect was found to be in agreement with the result obtained by Abe, Bowers, and Salpeter within the regime of Gibbs' statistical thermodynamics. Although the appearance of the binary correlation function obtained differs from those derived by Bowers-Salpeter and by O'Neil-Rostoker, it is shown that all of these expressions are essentially equivalent. According to the present analysis, however, it is proven that these expressions do not describe correctly the way in which correlation effects diminish at large distances and therefore the statement made by DeWitt saying that $g(x) \sim \frac{1}{8}(\ln 3)\epsilon^2 \exp(-k_D r)$ as $r \rightarrow \infty$ is not correct. (auth)

**44956** DETERMINATION OF PLASMA POTENTIALS AND ION ENERGIES BY ION EXTRACTION AND ENERGY ANALYSIS. **Erickson, C. W. (Univ. of Wisconsin, Madison). Rev. Sci. Instrum., 37: 1308-10(Oct. 1966). (COO-1233-28).**

The theory and operation of a new diagnostic tool for the extraction of ions from the main body of a confined plasma are discussed. The device, a magnetically shielding tube used in conjunction with an electrostatic energy analyzer and secondary electron detector, can be used for measuring ion energy distributions, plasma potential, and energy dependence of plasma ion lifetimes. Shielding properties and limitations of the device are also discussed. (auth)

**44957** E x B ENERGY ANALYZER FOR ELECTRONS. **Barr, W. L.; Perkins, W. A. (Univ. of California, Livermore). Rev. Sci. Instrum., 37: 1354-9(Oct. 1966). (UCRL-14455).**

A simple electron energy analyzer was used to measure energy distribution functions of the hot electron plasma produced in a compression mirror machine. The analyzer is located in a region of a steady 1.2-kG field so that electrons which escape from the 23-kG mirror field have most of their transverse energy transformed into the parallel component. This parallel component of energy is determined by the transverse drift in a region of mutually perpendicular electric and magnetic fields; low velocity electrons drift farther as they spend more time in the E × B field region, and vice versa. Electrons are detected by being accelerated onto a plastic scintillator which is viewed through a light pipe by a photomultiplier. Good time resolution is obtained, but since only one narrow energy band can be observed on each shot, the electric field is varied between shots to measure the complete energy spectrum. The magnetic field of the analyzer joins smoothly with the plasma containment magnetic field so that the electrons do not pass through a zero field region. With the 1.2-kG field, the analyzer works well for electron energies up to 20 kev; at higher energies the energy resolution decreases, and at very low energies (<100 ev) secondary electrons cause difficulties. (auth)

**44958** CHARGED PARTICLE CONCENTRATION WAVES IN A MOVING PLASMA. **Konenko, O. R.; Musin, A. K. (Lenin All-Union Electrotechnical Inst., USSR). Teplofiz. Vysok. Temp., 4: 12-19(1966). (In Russian).**

The flow was investigated for a quasineutral ionized gas, moving along magnetic force lines, with induced perturbation of the concentration of charged particles. It is assumed that the perturbation is due to the modulation of the concentration in some initial plane with a steady-state normal diffusion distribution of the concentration along the cross section. The charged particles are recombined on the walls of the channel as a result of ambipolar diffusion. The electron temperature decreases along the flow, as a result of which the coefficient of ambipolar diffusion decreases. Boundary conditions of the third type exist on the walls which confine the flow. Plane and cylindrical geometries of the channel are considered. A general expression is derived for parameters which characterize the mechanism of concentration wave propagation, and basic limiting cases are analyzed. A general solution is found for the problem of the propagation of rectangular concentration perturbations of charged particles, and some characteristics are studied. The mechanisms investigated may be used as a means for the physical diagnostics of plasma parameters, such as flow velocity, the coefficient of effective recombination, and the coefficient of ambipolar diffusion. (ATD)

**44959** SPECTROSCOPIC INVESTIGATION OF A PULSED LOW-VOLTAGE, DISCHARGE PLASMA IN A VACUUM. **Derevshchikov, V. A.; Deryabina, M. A. Teplofiz. Vysok. Temp., 4: 20-6(1966). (In Russian)**

Experimental results are presented of spectroscopic investigations of a pulsed discharge plasma on solid electrodes of a coaxial geometry, with an initial pressure in a vacuum chamber amounting to $10^{-5}-10^{-6}$ mm Hg. The Ornstein method is used to determine the excitation temperature in various sections of the torch. The distribution of two-fold aluminum ions is investigated according to their excited states. A temperature maximum of the plasma is established with a specific energy in the discharge. A determination is made of the radial distribution of temperature in an anode torch. A rise in temperature is observed with increasing distance from the anode. (ATD)

**44960** EXCITATION OF IONIC-ACOUSTIC WAVES IN A POTASSIUM AND CESIUM PLASMA. **Buchel'nikova, N. S.; Salimov, R. A. Teplofiz. Vysok. Temp., 4: 27-34 (1966). (In Russian).**

The excitation of ionic-acoustic waves in an almost isothermic potassium and cesium plasma ($T_e \sim 3T_i$) was investigated during the passage of electric current through the plasma. The natural frequencies of a limited system are found for the case when the plasma drifts along its axis. It is shown that when current is passed through, the oscillations are of the ionic-acoustic type. In particular, it is found that for potassium their phase velocity, equal to $(2.9 \pm 0.5) \times 10^5$ cm/sec, agrees with a theoretical value and with the value obtained by the direct measurement during the excitation of ionic sound by an external signal equal to $(3 \pm 0.4) \times 10^5$ cm/sec. The critical drift velocity ($v_{dr}$) is found for electrons in an electric field; as the $v_{dr}$ the following excitation of ionic-acoustic waves is observed: $(1.1 = 0.2) \times 10^7$ cm/sec. It is shown that this quantity is in good agreement with the theoretical value $v_{dr} = 1.3 \times 10^7$ cm/sec for the case $T_e = 3T_i$. (ATD)

**44961** ENERGY BALANCE OF A STEADY-STATE INDUCED DISCHARGE. **Rovinskii, R. E.; Gruzdev, V. A.; Shirokova, I. P. Teplofiz. Vysok. Temp., 4: 35-9(1966). (In Russian).**

An experimental investigation was made of a discharge in argon and xenon, induced in closed flasks. A study is made of the energy balance of a steady-state discharge in the pressure range from 1 to 750 mm Hg. The magnitude of thermal and radiant losses of the discharge was measured depending on gas pressure and the power of the discharge. It is found that the thermal and the radiant losses in the case of xenon are several times higher than those in the case of argon. At atmospheric pressure, the proportion of radiant losses in argon amounts to abcut 15% and drops substantially with decreasing pressure. The radiant losses in both xenon and argon as a function of pressure with a constant power in the discharge, are found to increase sharply at first, then, starting from about 200 to 300 mm Hg, to increase at a slower rate. It is asserted that the increase in the radiant power will, in some degree, continue even at pressures above atmospheric. (ATD)

**44962** INVESTIGATION OF THE INTERACTION OF SUPERSONIC TORCHES IN PULSE DISCHARGE. **Sul'tanov, M. A.; Kiselevskii, L. I. Teplofiz. Vysok. Temp., 4: 40-5(1966). (In Russian).**

An investigation was made of the influence of the interaction of counter torches of a pulse discharge on its structural and spectral characteristics. Modes of discharge were studied at which the vapor velocities in the torches were supersonic. An analysis of the data presented shows that in low-voltage discharges (0.25 to 0.5 kv) the vapors may have supersonic velocities only near the cutoff of the nozzle (1 to 3 mm from the cutoff). At high-voltage discharges (~3 kv), the region of supersonic flow in the intermediate stage of the pulse exceeds 10 to 15 mm. The mechanisms of the process are discussed. It is concluded that during the collision in the interelectrode gap of counter torches, moving at high velocities relative to each other, there forms a plasma compression shock region which may contribute fundamentally to the radiation of the discharge and, consequently, determine its spectral characteristics. Depending on the conditions of the advance of the electrode vapors, the compression shock regions may be either stationary in space and time, or moving in the interelectrode gap. The latter case pertains, as a rule, to discharge between open electrodes. (ATD)

**44963** MOTION OF A PLASMA JET ACROSS A NONUNIFORM MAGNETIC FIELD. **Sinelnikov, K. D.; Goncharenko, V. P.; Goncharenko, D. K. (Ukrainian Inst. of Physics and Tech.). Ukr. Fiz. Zh., 11: 825-8(1966). (In Ukrainian).**

Using Parker's equations, it is shown, that the motion of a plasma jet across a nonuniform magnetic field is decelerated if $\nabla B$ is positive, and is accelerated in decreasing fields. The drift velocity is described. Comparisons with experimental results are given and discussed. (auth)

**44964** INHIBITION OF INSTABILITIES IN A PLASMA COLUMN. Pavlov, E. I.; Sinitsyn, V. I. Zh. Eksp. Teor. Fiz., 51: 87-94(July 1966). (In Russian).

It is demonstrated experimentally that under certain conditions a straight plasma column carrying a current of 100 to 120 kA can be stabilized by employing a rapidly varying magnetic field. The stabilizing contour consists of six bus bars arranged symmetrically on the outer surface of the discharge chamber which has a diameter of 20 cm. The conclusion regarding the stabilization effect is drawn on basis of data obtained by streak photography of the radiation, magnetic probe measurements, and by means of a magnetic element which records the amount of energy escaping to the chamber walls. (auth)

**44965** THEORY OF AMPLIFICATION OF LONGITUDINAL WAVES BY A CHARGED PARTICLE BEAM IN A NONLINEAR PLASMA. Krasovitskii, V. B.; Kurilko, V. I. (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksp. Teor. Fiz., 51: 445-8(Aug. 1966). (In Russian).

The one-dimensional problem of amplification of a monochromatic longitudinal wave by a charged particle beam in a nonlinear plasma described by a dielectric constant $\epsilon = 1 - \omega_p^2/\omega^2 \exp(-E^2/E_0^2)$ ($\omega_p$ is the plasma frequency, $\omega$ the operating frequency, E amplitude of the excited field; $\omega < \omega_p$) is considered. It is shown that for a sufficiently high beam density the back effect of the excited oscillations on the motion of the beam particles can be neglected, at least in the vicinity of plasma resonance ($|\omega - \omega_p| \ll \omega_p$). The maximal amplitude of the amplified wave is found and also the dependence of the amplitude on coordinate are found. The possibility of appearance of accelerated particles at the amplifier output is mentioned. (auth)

**44966** NONLINEAR THEORY OF WAVE PROPAGATION IN SEMICONDUCTORS. Bass, F. G.; Gurevich, Yu. G. (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Zh. Eksp. Teor. Fiz., 51: 536-55(Aug. 1966). (In Russian).

Propagation of electromagnetic waves in a semiconductor is studied by taking into account nonlinear effects due to heating of the electrons by the field. Nonlinear anomalous and normal skin effects are considered. The character of field attenuation, and also the dependence of the effective electron temperatures, of frequency, of the incident field and its amplitude are studied for the resonance as well as nonresonance cases. It is shown that the effective temperature in the resonance case exceeds that in the nonresonance one. It is found that the attenuation depth of the electron temperature in the anomalous case is greater, and in the normal case, of the same order of magnitude as the attenuation depth of the field. The dependence of the surface impedance on the amplitude and frequency of the incident electromagnetic field and stationary magnetic field is found. The specific interaction of electromagnetic waves due to heating of the electron gas is considered. It is shown that propagation of small amplitude waves may considerably change in the presence of a large amplitude wave. (auth)

**44967** ION LINE SPLITTING DUE TO ROTATION OF THE IONS IN A MAGNETIC FIELD. Dyakonov, M. I. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz., 51: 612-16(Aug. 1966). (In Russian).

It is shown that if the cyclotron frequency of ion rotation in a magnetic field $\Omega$ exceeds the natural ion spectral line width $\gamma$ then the Doppler contour of each Zeeman component in the radiation directed across the magnetic field should split into a number of peaks. The distance between neighboring peaks is $\Omega$ and the width of each peak is determined by the natural width of the line $\gamma$. (auth)

**44968** DRIFT-CYCLOTRON OSCILLATIONS OF A COLLISION PLASMA PROPAGATING ACROSS A MAGNETIC FIELD. Bogdankevich, L. S.; Rukhadze, A. A. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz., 51: 628-38(Aug. 1966). (In Russian).

Drift-cyclotron oscillations of a spatially inhomogeneous low pressure plasma with collisions propagating across an external magnetic field were investigated. Particle collisions were taken into account by means of the Landau collision integral. Shortwave oscillations with a wavelength smaller than the Larmor ion radius but larger than the electron Larmor radius were considered. The oscillation spectra were analyzed in the geometric optics approximation. Dispersion relations were obtained for the ordinary, extraordinary, and plasma waves. The relations were employed for determining the local spectra of drift-cyclotron oscillations of an inhomogeneous plasma, and their increments were estimated. It is shown that with growth of the particle collision frequency, drift-cyclotron oscillations of a collisionless plasma go over to drift-dissipative oscillations which are characteristic only for a collision plasma. The stability of such oscillations significantly depends on nonuniformity of the plasma particle temperature. (auth)

**44969** WEAK TURBULENCE SPECTRUM IN A PLASMA WITHOUT A MAGNETIC FIELD. Zakharov, V. E. Zh. Eksp. Teor. Fiz., 51: 688-96(Aug. 1966). (In Russian).

A kinetic equation describing four-plasmon processes in a plasma without a magnetic field is derived and it is shown that it has an exact solution. The solution may be interpreted as the turbulence spectrum in the universal equilibrium region. It is demonstrated that the turbulence is of a local-isotropic nature. (auth)

**44970** MAGNITNYE LOVUSHKI. (Magnetic Traps). Sinel'nikov, K. D. (ed.). Fizika Plazmy i Problemy Upravlyaemogo Termoyadernogo Sinteza. (Plasma Physics and Problems of Controlled Thermonuclear Synthesis). Kiev, Naukova Dumka, 1965. 227p.

Separate abstracts were prepared for 19 of the included 24 papers. The remaining papers appeared previously in NSA as 19: 33467, 20: 10196, 19639, 36327, and 36329. (M.O.W.)

*For abstracts of individual papers see: 43457, 43458, 43498, 43499, 44131, and 44971—44984.*

**44971** INJECTION OF PARTICLES INTO A MIRROR TRAP WITH AN INCREASING FIELD THROUGH A MAGNETIC CUSP CONFIGURATION. Sinel'nikov, K. D.; Khizhnyak, N. A.; Repalov, N. S.; Zeidlits, P. M.; Yamnitskii, V. A.; Azovskaya, Z. A. pp 5-18 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The behavior of a plasma in a magnetic mirror trap formed by particles injected through a cusp configuration is studied. The particles selected for investigation are those which at injection have curvature radius of less than 71% of the Larmor radius, i.e., those which proceed without reflection into the magnetic mirror region. The eccentricity of the particle trajectory (passing through the zero field plane) due to the cusp configuration is analyzed. Two competing processes become evident; one tends to establish an E-layer as in the Astron machines and another tends to fill the axial region of the mirror trap. The analysis is further extended to determine the accumulation in the magnetic mirror trap of particles passing through a smooth cusp field having only a zeroth harmonic. The conversion of longitudinal energy into transverse particle energy is determined as a function of the initial radial distance of the trajectory from the magnetic axis. The number of particles trapped indicates that construction of an experimental machine is feasible provided the proper magnetic field configuration is used. It is estimated that a field with high harmonic components would trap particles with broader initial velocity and injection angle parameters. (ATD)

**44972** CONFINEMENT OF CHARGED PARTICLES PULSE-INJECTED INTO A TRAP WITH STATIONARY FIELDS. Akshanov, B. S.; Volkolupov, Yu. Ya.; Sinel'nikov, K. D. pp 27-35 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

Experimental injection of charged particles into magnetic traps is studied using high power electron guns in which the accelerating potential, amplitude and duration were regulated to produce square, half-sine, and sawtooth waves. The magnetic coils and field configuration are described. Probing electron beams and luminescent screens were used to show that plasma confinement time is in the tens of microseconds and depends on such parameters as initial density, injection pulse time and amplitude. The luminescent screen surrounding the plasma gives evidence that the injected beam strikes the wall at critical energies. Plasma confinement time and the onset of a rapid breakup of the plasma are increasingly delayed as the initial pressure increases. The method employed can produce $10^{12}$ $cm^{-3}$ plasma. The resulting plasma is very similar to one produced by continuous injection but it maintains high electron temperatures for a somewhat longer time. (ATD)

**44973** CHARGE DRIFT IN SPATIALLY PERIODIC MAGNETIC FIELDS. Kovtun, R. I. pp 45-71 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The motion of charges in a constant magnetic field which consists of a strong longitudinal field $H_0$ directed along axis Oz and a weak magnetic disturbance which is periodically dependent on z is discussed. This periodic perturbation is assumed to be cylindrically symmetric. The problem is solved by the asymptotic method. The calculation is limited to particles with trajectories which pass through the axis of symmetry of the magnetic field and which are not deflected too far from this axis. It is shown that this has absolutely no limiting effect on paraxial rays and that the angle which the charge velocity makes with the axis of symmetry may vary within rather wide limits which may be extended by a more exact approximation of the magnetic field which appears in the equations of motion. Although this makes the computations more laborious, no fundamental difficulties are introduced. The problem is solved in the resonance region and for the case of high transverse velocities. It is shown that when charges drift in a spatially periodic magnetic field with velocities close to the resonance velocity, more than half the kinetic energy of the longitudinal component of motion may be periodically converted to Larmor rotation energy. (ATD)

**44974** EXACT RESONANCE DURING CHARGE DRIFT IN SLOWLY VARYING SPATIALLY MODULATED MAGNETIC FIELD. **Kovtun, R. I.** pp 71-8 of **Magnitnye Lovushki. Sinel'nikov, K. D. (ed.).** Kiev, Naukova Dumka, 1965. (In Russian).

The motion of charges is considered in a cylindrically symmetric-magnetic field which is a superposition of two fields, viz. a strong field $H_0(z)$ which varies slowly with coordinate z and a weak field $\epsilon H_0(z) \cos \nu z$ $(|\epsilon|) \ll 1$. In other words, the field $H_0(z)$ is modulated by an auxiliary field which is periodically dependent on z but has a constant depth of modulation $\epsilon$. This problem may be of practical interest since the slow variation of the fundamental (strong) field may be selected in such a way that when certain conditions are fulfilled, the energy of the longitudinal motion of the charge in this field will be continuously "transferred" to Larmor rotation energy and back. It is shown that a nonhomogeneous magnetic field $H_0(z)$ may be chosen which varies in space in proportion to the longitudinal component of velocity of particle $\nu_z(z)$ to satisfy resonance condition for an arbitrarily long time and raise the energy of a particle which may be transferred from energy of longitudinal motion to "transverse" energy and back. Thus it is assumed that a constant ratio $H_0(z)/\nu_z(z) = C$ is given so that velocity $\nu_z$ and consequently the magnetic field $H_0(z) = C\nu_z(z)$ may be calculated. Only particles with trajectories passing through the axis of symmetry of the system are considered. It is found that an increase in radial field intensity with radius causes a more rapid change in the fundamental field in the case of exact resonance since this field amplification with coordinate r amounts to the same thing as increasing the depth of modulation. (ATD)

**44975** INTERACTION BETWEEN PLASMOIDS OF A MAGNETIC FIELD OF ACUTE-ANGLED GEOMETRY. **Kalmykov, A. A.; Trubchaninov, S. A.; Naboka, V. A.** pp 78-86 of **Magnitnye Lovushki. Sinel'nikov, K. D. (ed.).** Kiev, Naukova Dumka, 1965. (In Russian).

Plasma capture in an acute-angled trap was investigated using methods which permit measurements for particles with various energies for a more detailed investigation of the mechanism responsible for the interaction between a plasmoid and a magnetic field of acute-angled geometry. The acute-angled magnetic field was produced by the appropriate connection of two coils. Maximum field intensity was approximately 6000 oersteds. A drift spectrometer and a plasmascope were used for an experimental investigation of the plasma emerging from the trap. It was found that paraxial ions escape from the trap along the axis, i.e., ions which are in motion in the region near the axis and make an extremely small angle with the axis. The energy spectra of hydrogen ions from plasmoids after passage through a magnetic field of acute-angled geometry were compared with similar spectra for ions after passage through a homogeneous magnetic field of the same intensity. It was found that the acute-angled field cuts off the high energy ions. Energy spectra are also given for plasmoid protons after emergence from an acute-angled trap as a function of magnetic field strength. These curves show a reduction in the number of ions passing through the trap as the magnetic field strength is increased. An analysis of the experimental plasmograms shows that the plasma is initially pinched as it enters the trap and that the central part of the plasma then moves along the axis. A halo forms around this dense central section with a radius which increases with motion along the axis in spite of a simultaneous increase in the magnetic field intensity. The generation of this halo and the increase in its diameter may be due to rotation caused by some mechanism which converts the longitudinal edge component to a transverse component. The experimental data show that the leading edge of an acute-angled plasmoid is not captured and passes through the end of the trap. A more detailed study of the interaction between plasmoids and an axially symmetric magnetic field is needed for determining conditions necessary for trapping a fast plasma. (ATD)

**44976** MEASURING THE ENERGY OF RECHARGED PARTICLES IN AN ELECTROMAGNETIC TRAP. **Lavrent'ev, O. A.; Nemashkalo, B. A.; Ovcharenko, L. I.; Safronov, B. G.; Sidorkin, V. A.** pp 86-8 of **Magnitnye Lovushki. Sinel'nikov, K. D. (ed.).** Kiev, Naukova Dumka, 1965. (In Russian).

The energy of a stream of recharged particles emerging from the end aperture in an electromagnetic trap was measured. A diagram of the experimental equipment is given together with a brief description. Mass analysis of the stream of recharged particles emerging from the trap showed that it consists almost entirely of atomic hydrogen. Curves are given showing the energy distribution of ionized atoms with a residual gas pressure in the trap of $2 \times 10^{-6}$ mm Hg and injected electron energies of 2 and 2.8 kev. The density of the energy distribution for the recharged particles is related to the density of the energy distribution for the stream of ions in the trap by the formula $N_0(U) = \sigma_{10}(U)n_0RN_i(U)$, where $\sigma_{10}$ is the charge exchange cross section; $n_0$ is the density of the residual gas; R is the radius of the region occupied by the plasma. This relationship may be used to establish the energy distribution of the stream of ions circulating in the trap from the distribution of neutral ions. By narrowing the time interval for registration of the recharged particles, the variation in the intensity of a stream of ionized atoms of a given energy may be plotted as a function of time, which means that the same may be done for the intensity of ions of a given energy in the trap. It is shown that there is a hot plasma with an average ion energy of the order of 400 ev in an electromagnetic trap when the injected electrons have an energy of the order of 2 kev. The decay time after the injection pulse is 50–80 $\mu$sec which agrees with the previously measured lifetime for hot electrons in this trap. A comparison of the lifetimes for ions with various energies shows large losses of low energy ions. This is apparently due to an increase in the cross section of resonance charge exchange for hydrogen ions at low energies. (ATD)

**44977** INVESTIGATION OF A NONADIABATIC MAGNETIC TRAP. **Slabospitskii, A. P.** pp 89-104 of **Magnitnye Lovushki. Sinel'nikov, K. D. (ed.).** Kiev, Naukova Dumka, 1965. (In Russian).

A magnetic system is studied where charged particles are held in resonance with a spatially periodic magnetic field by reducing the intensity of the principal magnetic field with respect to the spatially periodic system in synchronization with a reduction in the longitudinal component of the velocity of the charged particles. It is shown that a group of particles appears after reflection from the second magnetic mirror and that these particles immediately escape from the magnetic trap. This group of charged particles has a decisive effect on the measured current. The number of electrons formed during ionization of the residual gas was determined. The installation used for measuring the average path traversed by a charged particle in a magnetic trap is described. The curve for the average path at resonance of a charged particle in the magnetic trap as a function of pressure shows a sharp maximum at $2.5 \times 10^{-6}$ mm Hg which is the low pressure limit for the proposed method due to losses of fast particles at the walls. Data on the average path of the fast electrons in the trap and their average longitudinal component of velocity were used for estimating the time which the charged particles were held in the magnetic trap. These estimates give a value of 16 $\mu$sec for a distance between mirrors of 300 cm and 80 reflections between mirrors. Experimental results showed that the majority of the particles passing through the first (injection) mirror are electrons. The number of particles which pass through the injection mirror depends on pressure. A curve is given showing the ratio of streams passing through the first and second mirrors as a function of residual gas pressure. The fraction of particles escaping from the trap through the injection mirror also increases with injection current. The behavior of the charged particles after the first reflection from the magnetic mirror was studied by using a screen with a radial slit which was coated with a phosphorescent material on two sides. The primary beam was passed through the slit and the beam reflected from the magnetic mirror was observed on the screen. A cylindrical beam of charged particles appears at the input of the spatially periodic magnetic field after reflection from the second mirror. The reflection areas are diffused, especially on the injection mirror side. A small trap is formed with a distance of about 70 cm between the ends of the reflection areas. The magnetic field of the reflection area on the injection mirror side is smaller than that of the reflection area on the second mirror. There are three groups of particles which interact in different ways with the spatially periodic magnetic field: one group increases its own transverse component of energy, a second changes it weakly and the third converts the transverse energy component to a longitudinal component. (ATD)

**44978** DISTRIBUTION OF PRESSURE ALONG A COAXIAL SYSTEM AFTER PULSED GAS ADMISSION. Zolototrubov, I. M.; Ryzhov, N. M. pp 116-20 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

It is shown that a MI-10S ionization manometer may be used for measuring pulsed pressures. This is a plane-parallel manometer with the cathode placed between the anode and the collector and may be used for measuring pressures from $1.33 \times 10^{-3}$ to 133 $N/m^2$. The manometer has a thorium oxide cathode on an iridium base which is more resistant to poisoning than the usual tungsten cathode. The manometer has small overall dimensions which permit operation in restricted spaces. Measurements showed that the sensitivity of the manometer is independent of the emission current. A comparison between readings of the MI-10S manometer and those of the LT-2 thermocouple manometer under stationary pressure conditions showed no significant differences. The average sensitivity in all pressure ranges was found to be $5.56 \times 10^{-3}$ $N/m^2$. The error in pressure determination is no more than 10–15%. The instrument was used for measuring the distribution of pulsed pressure of a neutral gas along a coaxial plasma gun with the following geometric parameters: length 66 cm, diameter of the external electrode 6.5 cm, diameter of the central electrode 3 cm. Curves are given showing the pressure distribution for hydrogen along the gun at various times with respect to the initial opening of the valve. It was found that the velocity for propagation of the gas front reduces as the density of the front increases. The gas is propagated at a higher velocity as the quantity of the admitted gas is increased. The method described may be used for measuring pulse pressure in any systems and in any pressure ranges. Logarithmic amplifiers must be used for pressure variations in extremely wide ranges. (ATD)

**44979** CESIUM IONIZATION UNDER THE SIMULTANEOUS ACTION OF HIGH PRESSURES AND TEMPERATURES. Mitin, R. V. pp 156-61 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The effect of ionization on cesium vapor under the combined action of high pressures and temperatures is calculated. Cesium has an ionization potential of 3.9 ev which is lower than that of any other element and therefore requires less pressure and temperature for ionization than any other material. A modified Saha equation was used for calculating the effect of ionization with regard to reduction of the ionization potential of atoms in a dense plasma. The cesium ionization curves are compared with the melting curve and the saturated vapor tension curve. The ionization curves and the saturated vapor curve are bounded by a nearly closed region of unionized cesium. To the left of this region is liquid metallic cesium, to the right is the plasma region and above, at pressures greater than $(1-2) \times 10^3$ atm, is a region of pressure-ionized cesium. The properties of cesium in this region should be intermediate between those of liquid metallic cesium and those of a cesium plasma. It is found that when $n_i \simeq 2 \times 10^{21}$, $p \simeq 2 \times 10^3$ atm, and $T \simeq 2 \times 10^{3}$°K, the electrical conductivity of cesium $\sigma \simeq 10^3 \Omega \cdot cm^{-1}$ which is $\frac{1}{50}$ of the electrical conductivity of solid metallic cesium and approximately 100 times the electrical conductivity of a completely ionized rarefied cesium plasma at the same temperature. It is pointed out that the results are semiquantitative due to certain simplifying assumptions made in the calculations. However, the formulas should give reasonably accurate results in the high density region. (ATD)

**44980** PRELIMINARY PHOTOIONIZATION OF HELIUM IN A GAS DISCHARGE SHOCK TUBE. Aseev, G. G.; Konovalov, V. G. pp 161-5 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

An electrostatic probe, microwave techniques, and photomultiplier techniques are used for experimentally showing that preliminary ionization of helium of the order of 1% observed in a shock tube at initial pressures of $(3-6) \times 10^{-1}$ mm Hg is due to photoionization by ultraviolet radiation from the discharge ($\lambda < 1100$ angstrom). One of the direct proofs of this hypothesis is the presence of helium ions before arrival of the shock wave and the plasma discharge at a given point of the shock tube. The experimental method and equipment are described in detail. Analysis of the experimental data shows that a plasma with a density of $10^{13}$ $cm^{-3}$ is generated 30 cm from the coil. This plasma is generated before arrival of the discharge plasma simultaneously throughout the length of the tube. If the diaphragm of the probe is closed with a sheet of lithium fluoride, the antecedent signal disappears completely. The experimental results show that the observed antecedent ionization of helium is due to photoionization by the hard ultraviolet discharge. (ATD)

**44981** MICROWAVE REFRACTION BY A NONHOMOGENEOUS CYLINDRICAL PLASMA. Dushin, L. A.; Kovtun, R. I.; Privezentsev, V. I.; Skibenko, A. I. pp 166-79 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The propagation is considered for a microwave beam through a cylindrical plasma with radial density distribution of the form $N(r)/N_{cr} = k[1 - (r/r_0)^\gamma]$ where $k = N_{max}/N_{cr}$ and $N_{max}$ is the density at the axis of the cylinder. This expression is integrated with respect to the radius and then averaged to give $\gamma = \overline{N}/N_{max}/1 - N/N_{max} = \overline{N}/N_{max} - \overline{N}$, where $\overline{N}$ is the density averaged with respect to the radius. Thus a distribution function may be easily found which gives a nearly homogeneous form of distribution at large $\gamma$ and is close to a $\delta$-function when $\gamma \rightarrow 0$, by simultaneously measuring the maximum density and the density averaged with respect to the radius. The trajectory of a microwave beam in a cylindrical plasma is calculated and the effect of beam distortion during measurement of signal attenuation is considered. Experiments are conducted to determine the density distribution in a discharge column. (ATD)

**44982** DETERMINATION OF THE SPATIAL DENSITY DISTRIBUTION OF A PLASMA USING MICROWAVE REFRACTION. Dushin, L. A.; Kononenko, V. I.; Skibenko, A. I. pp 179-88 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

A method is proposed for using refraction of microwave beams to determine the spatial density distribution of a plasma on the basis of a single probing frequency for any moment of time. The method is applicable both to the case of a flat plasma and also for cylindrical plasma formations. In the case of a plasma with a plane or nearly flat surface, the spatial distribution may be found from the refraction of microwave beams which are incident at an angle to the surface of the plasma. There is a continuous change in the direction of the microwave beam due to the density gradient in the plasma. Analytical formulas are given for determining the density distribution from the trajectory of the beam in the plasma. When the plasma being studied is axially symmetric, the spatial density distribution may be determined from the refraction of microwave beams in a plane normal to the axis of the discharge. The use of this method is discussed. The proposed methods may be improved by using microwave beams with small apertures and by operation on shorter wavelengths. (ATD)

**44983** STUDYING A PLASMA BY PROBING WITH MICROWAVES. Dushin, L. A.; Kononenko, V. I.; Kovtun, R. I.; Privezentsev, V. I.; Skibenko, A. I. pp 189-98 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The spatial density distribution function for a plasma was determined by comparing the average density measured by a microwave interferometer with the maximum density determined from the cutoff time of the microwave signals. These data were used for finding the recombination and diffusion coefficient and for estimating the electron temperature in the discharge. The experimental procedure is described in detail and the derivation of the analytical formulas used is discussed. It is shown that curves for the average and maximum plasma densities or their logarithms as functions of time will coincide as long as there is no noticeable diffusion to destroy the initial distribution. The results confirm the data in the literature obtained by spectroscopic analysis of a Phillips discharge. (ATD)

**44984** BREMSSTRAHLUNG OF A $\theta$-PINCH PLASMA IN THE INFRARED SPECTRAL REGION. Dushin, L. A.; Kononenko, V. I.; Pavlichenko, O. S.; Nikol'skii, I. K. pp 198-206 of Magnitnye Lovushki. Sinel'nikov, K. D. (ed.). Kiev, Naukova Dumka, 1965. (In Russian).

The various methods used for determining the parameters of a plasma from the intensity of bremsstrahlung are reviewed. If the receiver design does not permit wavelength adjustment, the absolute intensity of the bremsstrahlung in the plasma is measured in a definite wavelength range and an independent method is used for determining one of the parameters of the plasma, e.g., the electron temperature, and its variation with time. These data are then used as a basis for determining the plasma density and its variation. The possibilities of using this type of a receiver for plasma diagnosis are discussed. Experiments were conducted which showed that the continuous radiation of a plasma in the near infrared region may be measured simultaneously with the electron temperature to determine the density of the plasma and its variation with time. The sensitivity of this method may be improved by reducing the band of the preamplifier of the recording system and by making the measurements on a plasma in which slower processes take place since this would allow covering a wider density range. (ATD)

**44985** REVIEWS OF PLASMA PHYSICS. VOLUME 2. Leontovich, M. A. (ed.). New York, Consultants Bureau, 1966. 302p. $12.50.
Translated from Russian by Herbert Lashinsky.

Included are four papers concentrated on aspects of the problem of plasma confinement: the structure of magnetic fields, plasma equilibrium in magnetic fields, hydromagnetic stability of a plasma, and motion of charged particles in electromagnetic fields. (M.O.W.)

**44986** MAGNETOHYDRODYNAMIC STABILITY AND THERMONUCLEAR CONTAINMENT. Jeffrey, A.; Taniuti, T. (eds.). Perspectives in Physics. A Series of Reprint Collections. New York, Academic Press, 1966. 229p. $7.50.

Included are 13 papers describing aspects of MHD stability and thermonuclear containment: introduction, energy principle for hydrodynamic stability problems, some instabilities of a completely ionized plasma, finite-resistivity instabilities of a sheet pinch, instability of a positive column in a magnetic field and the anomalous diffusion effect, stability of plasmas confined by magnetic fields, finite Larmor radius stabilization of weakly unstable confined plasmas, hydromagnetic instability in a stellarator, influence of an axial magnetic field on the stability of a constricted gas discharge, stability of a linear pinch, hydromagnetic stability of a diffuse linear pinch, stability and heating in the pinch effect, and some stable plasma equilibria in combined mirror-cusp fields. (M.O.W.)

## Shielding

**44987** (AD-637685) MONTE CARLO TECHNIQUE APPLIED TO THE CALCULATION OF GAMMA-RAY TRANSPORT IN COMPARTMENTED STRUCTURES. Haggmark, L. G. (Naval Radiological Defense Lab., San Francisco, Calif.). May 3, 1966. 31p. (USNRDL-TR-1038). CFSTI $2.00 cy, $0.50 mn.

A Monte Carlo computer code was assembled to calculate the transport of gamma rays in three-dimensional, rectangular geometry. The code uses the statistical estimation technique to compute the flux and dose at several space points. The code was applied to two compartmented iron structures that had been experimentally investigated The Monte Carlo and experimental results compare well, i.e., within 20%, in most cases. In a few cases for one structure, where the radiation was incident at large angles from the normal to one wall, the comparison between the results was less than satisfactory. The experimental value was a factor of 6 greater than the Monte Carlo value in the worst case. (auth)

**44988** (NASA-TM-X-1287) EXPERIMENTAL NEUTRON FLUX ALBEDO FOR CONCRETE. Kish, James A.; Myers, Ira T.; Smithrick, John J. (National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center). Sept. 1966. 16p. CFSTI $1.00 cy, $0.50 mn.

Thermal neutron flux albedo for concrete due to an incident fast-neutron beam is of interest in predicting activation of a nuclear-rated space chamber. Some measurements of this quantity were made for limestone concrete by using plutonium-beryllium and reactor-beam neutron sources. In both cases, measurements were made by using a moving-detector technique to perform the integration of emergent thermal neutron flux. The accuracy of results for the reactor source was limited by lack of beam-spectrum data, but a value of flux albedo for the PuBe source was determined to be 0.13 ± 0.04. (auth)

**44989** EQUIVALENT MATERIAL THICKNESSES FOR GAMMA RADIATION ATTENUATION. Hoenig, Arnost (Vysoke Uceni Technicke, Brno). Jad. Energ., 12: 296-8(1966). (In Czech).

Tables are included of thicknesses of various materials as heavy and ordinary as concrete, aluminum, water, and steel, for gamma radiation attenuation equivalent to lead thickness in the dependence of photon energy. (auth)

**44990** RADIATION PROTECTION DURING THE FLIGHT IN SATELLITES "VOSKHOD I" AND "VOSKHOD II". Volynkin, Yu. M.; Antipov, V. V.; Davydov, B. I.; Dobrov, N. N.; Nikitin, M. D.; Pisarenko, N. F.; Saksonov, P. P. Kosm. Issled., 4: 630-3(July-Aug. 1966). (In Russian).

Data obtained from the Voskhod-2 flight indicated that the radiation dose for the personnel did not exceed several tenths of bar per 24 hour flight. The system of safety measures and the individual dosimeters capable of measuring radiation doses in condition of deep vacuum are described. The total radiation doses for the personnel of the Voskhod-1 was 30 ± 5 and for the Voskhod-2 it was 70 ± 5 mrad. Analysis of the radiation measured by means of nuclear emulsions indicated particle flux with linear energy losses corresponding to He, B, O, and Ar ions. (R.V.J.)

## Solid State Physics

***See also*** **CHEMISTRY — Inorganic and Physical Chemistry**
**METALS, CERAMICS, AND OTHER MATERIALS — Properties and Structure**

*Refer also to abstracts 43646, 43950, 44004, 44012, 44135, 44916, and 44966.*

**44991** (BNL-10544) CHANNELING AND RELATED EFFECTS IN THE PASSAGE OF CHARGED PARTICLES THROUGH CRYSTAL LATTICES. Erginsoy, Cavid (Brookhaven National Lab., Upton, N. Y.). Aug. 1966. Contract AT(30-2)-Gen-16. 31p. (CONF-660923-2). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Solid State Conference on Interaction of Radiation with Solids, Cairo, Egypt.

Under certain conditions in a crystalline solid the impact parameters of successive collisions of energetic ions may become correlated and their distribution is not random. Hence, the yield of the same reaction for a given pathlength of the ion may depend strongly on direction. Some aspects of the theory of such directional effects are discussed in terms of "channeling" and "blocking" experiments, average potentials for atom rows and planes, multiple scattering of particles into channels, correlated motion of particles with small impact parameters, channeled particles, and use of directional effects in solid state physics. (W.D.M.)

**44992** (IS-T-108) FREQUENCY DEPENDENCE OF THE MAGNETIZATION OF HOLMIUM IN THE NEIGHBORHOOD OF THE FERROMAGNETIC ORDERING TEMPERATURE. Olander, Farley (Ames Lab., Iowa State Univ. of Science and Tech.). May 1966. Contract W-7405-eng-82. 54p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Thesis.

From frequency dependence studies of polycrystalline holmium, the form of the complex susceptibility as a function of frequency in the range 20-110 cps was determined. It was found that above 20 cps the susceptibility is being measured above the resonance frequency, which means that a-c susceptibility results above 20 cps will not agree with static susceptibility results. It was found that measurable losses occurred at all experimental frequencies. A model was established to relate the susceptibility to the domain wall displacement. From this it was hoped that the damping parameter could be determined. It was found that the model was inconsistent with the experimental data. The possibility of any time dependence of the isothermal susceptibility in the vicinity of the Curie point was investigated. From the results it was concluded that there is no kinetic effect present. (auth)

**44993** (NYO-2150-19) ASPECTS OF HELICON PROPAGATION IN METALS. Merrill, John Raymond (Cornell Univ., Ithaca, N. Y. Materials Science Center). Sept. 1966. Contract AT(30-1)-2150. 117p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Thesis.

The helicon is an electromagnetic wave which can propagate in the electron gas of a solid in the presence of a large magnetic field. This wave motion is analogous to excitations known as "whistlers" in ionospheric physics and has been studied since 1961 in both metals and semiconductors. Several experiments are discussed which concern the basic properties of the helicon wave in metals and the use of the wave to measure electronic properties of interest to solid-state physics. A brief résumé of the properties of the helicon wave is given. Mode structure for helicon standing wave resonances is then discussed with particular emphasis on experiments probing the so-called transverse modes and even modes. Size effects in d-c galvano-magnetic experiments as well as in helicon propagation are discussed. The size effects are not sufficient to explain published anomalies in Doppler-shifted cyclotron resonance studies. An attempt at the pulse propagation of helicon waves is discussed, and suggestions are made concerning possible new experiments. The ability of standing wave helicon resonances to measure the anisotropy of the magnetoresistivity and the Hall coefficient is discussed in detail, and experimental examples with aluminum and silver are used to demonstrate the merits and demerits of the method. The absolute calibration of uncorrected superconducting solenoid magnets is discussed in some experiments not directly related to the helicon. The experiments utilize nuclear magnetic resonance at low temperatures (4°K). Results on the inhomogeneity of a 50 kG superconducting magnet are included. (auth)

**44994** (NYO-3464-2) ZERO-PHONON LINE LUMINESCENCE AT COLOR CENTERS IN ALKALI HALIDES. Fitchen, D. B. (Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics). Apr. 1966. Contract AT(30-1)-3464. 8p. (CONF-660818-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Conference on Luminescence, Budapest, Hungary.

The necessary conditions for zero-phonon lines in terms of a simple configuration diagram are reviewed. Some narrow lines in emission spectra of color centers in alkali halides are identified and analyzed. Special attention is given to the lines at 8333 Å and 10404 Å in LiF at 4.K. The isotope effect, when $^{6}$LiF instead of $^{7}$LiF is the host lattice, is shown for the 10404 Å line and its one-phonon sideband. (M.H.R.)

**44995** (ORNL-TM-1392) PHOTOELECTRIC AND OPTICAL PROPERTIES OF COMMERCIAL PLATINUM, GOLD AND PALLADIUM FOILS AND EVAPORATED ALUMINUM AND SILVER FILMS IN THE EXTREME ULTRAVIOLET. Stanford, J. L.; Arakawa, E. T.; Birkhoff, R. D. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 114p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Thesis. Submitted by J. L. Stanford to Univ. of Tennessee, Knoxville.

The purpose of the work reported was to extend photoelectric measurement on Ag and Al under good vacuum conditions into the ultraviolet region beyond the LiF cutoff in order to obtain, with a knowledge of the optical properties of these metals, information about mean free paths of electrons with energies of the order of 10 ev above the Fermi level and the scattering processes in which they are involved. In order to develop the proper methods and equipment for obtaining photoemission data, initial measurements were made on commercial foils of Pt, Au, and Pd for which data was available in the literature. (W.D.M.)

**44996** DISCOLORATION OF PURE AND Ca-DOPED KCl AND NaCl CRYSTALS UNDER THE ACTION OF GAMMA RADIATION. Froehlich, F.; Altrichter, S. (Martin-Luther-Univ., Halle, Ger.). Ann. Physik (7), 17: 143-59(1966). (In German).

It is shown that the time pattern of F-center formation in NaCl and KCl crystals under the effects of $\gamma$ radiation can be represented by an equation analogous to that used for x radiation. With consideration of the irradiation temperature and after determination of the intensity dependents of the parameters, the effect of defined dopings of the crystal with Ca ions was studied. It was found that the concentration of anion vacancies responsible for the F-center formation increases proportionally to the number of free cation vacancies, which is related to the efficiency of the Crawford-Nelson mechanism. At small Ca concentrations there is a need for approximately 2 Ca ions per additional F center, and for higher concentrations the Ca ion need increases strongly. In KCl crystals it is always higher than in NaCl crystals. In KCl crystals precipitation processes are noticeable at relatively low Ca concentrations. The difference in the bleachability between nominally pure KCl and NaCl crystals can be explained by the different concentration of two-valent cations. The energy sum absorbed by the $^{192}$Ir $\gamma$ radiation used during the bleaching in the crystal was determined and the upper limit for the formation energy per F center was determined. In the initial pattern the bleaching appears independent of the intensity and is 50 ev for KCl and 35 ev for NaCl. The formation energies were affected only slightly by the Ca concentration. In the linear part of the formation curve the formation energies are 100 to 1,000 times higher than in the initial part. (tr-auth)

**44997** GAMMA-RAY-INDUCED CONDUCTIVITY IN INSULATING POLYMERS. II. Furuta, Junichiro; Hiraoka, Eiichi; Okamoto, Shinichi. Ann. Rep. Radiat. Center Osaka Prefect., 6: 83-6(1965).

The gamma-ray induced conductivity for polyethylene and PMMA was measured at fixed dose-rate and various temperatures (25°C ~ 90°C). The temperature dependence on induced and decay current was studied. The amount of induced currents increased with temperature and the time, when the induced current achieved nearly equilibrium values from dark currents, decreased with temperature. The curves of decay currents can be divided into more than two linear parts which have different decay time constants. Their values decreased with temperature. (auth)

**44998** ANOMALOUS EFFECT OF ELECTRON BEAM IRRADIATION ON SILICON AND GERMANIUM. Sivertsen, David R.; Cecil, Olin B.; Haberecht, Rolf R. (Texas Instruments Inc., Dallas). Appl. Phys. Lett., 9: 123-5 (Aug. 1, 1966).

Exposure of samples of single-crystal Si and Ge to single 5-μsec pulses of electron-beam energy resulted in the preferential formation of peaks of single-crystal material in the exposed areas. Each peak appeared to contain more material than was removed from the area surrounding it. No voids or discontinuities appeared. An epitaxial layer deposited on the surface of the peak and the surrounding unexposed area was uniform in thickness and single-crystal in structure. Pulsing conditions appeared to control the formation of the peaks. (A.G.W.)

**44999** RARE EARTH GRAPHITE INTERCALATION COMPOUNDS. Craven, W. E.; Ostertag, W. (Air Force Materials Lab., Wright-Patterson Air Force Base, Ohio). Carbon, 4: 223-6(July 1966).

A group of new Me-graphite compounds, where Me represents the elements Gd, Tb, Dy, Ho, Er, Tm and Yb was prepared. The compounds were formed by reacting graphite with a metallic solution of rare earth elements in liquid ammonia. Except for ytterbium, which dissolves directly in liquid ammonia, all other rare earths had to be dissolved by electrolytic techniques using a Pt-cathode, a rare-earth anode and $NH_4I$ as an electrolyte. The intercalation compounds were analyzed for Me, C, N, H, and I. Magnetic susceptibility measurements were carried out at several temperatures between 80° and 290°K. The measurements indicate that in Gd-, Tb-, Dy-, Ho-, Er- and Tm-graphite the rare earths are present in the trivalent state. In ytterbium graphite, ytterbium has an effective valency between two and three. X-ray data are discussed. (auth)

**45000** NUCLEAR MAGNETIC RESONANCE IN NICKEL PARTICLES WITH A SINGLE DOMAIN. Aubrun, Jean-Noel; Khoi, Le Dang (Univ., Paris, Orsay, France). Compt. Rend., Ser. B, 263: 249-52(July 18, 1966). (In French).

The NMR of $^{61}$Ni nuclei was previously observed in a powder composed of grains with single domains of metallic nickel. As an extension of this work, a systematic study of NMR in the single-domain nickel powder was repeated and the results were compared with the results obtained from a multi-domain powder. (G.O.Y.)

**45001** IRRADIATION OF N SILICON WITH ELECTRONS AT ENERGIES BELOW 300 kev. Vapaille, Andre (Univ., Paris, Orsay, France). Compt. Rend., Ser. B, 263: 453-6(Aug. 8, 1966). (In French).

The effects of electron radiation on the resistivity of epitaxic shells and on the lifetime of ordinary levels were studied. It is shown that two types of acceptor centers are created and their levels are determined. The first, near $E_c = 0.16$ ev, appears in materials which are rich in oxygen and can be identified as an A center. The second, near $E_c = 0.13$ ev, appears in materials containing little oxygen. (tr-auth)

**45002** NEUTRON DIFFRACTION STUDY OF $U_2C_3$. De Novion, Charles (CEN, Fontenay-aux-Roses, France); Krebs, Jean-Pierre; Meriel, Pierre. Compt. Rend., Ser. B, 263: 457-9(Aug. 8, 1966). (In French).

The crystalline structure of $U_2C_3$ was investigated using neutron-diffraction analysis, but no evidence of a magnetic order was observed at liquid He temperatures. The fact that this magnetic order may exist may not be excluded, but it could not be detected due to the low magnetic moment of uranium. (tr-auth)

**45003** EFFECT OF THE ANISOTROPY OF THE CRYSTALLINE ENVIRONMENT ON THE ENERGY LOSS OF ELECTRONS TRAVERSING A CRYSTAL. Cazaux, Jacques; Vilanove, Roger (College de France, Paris). Compt. Rend., Ser. B, 263: 460-2(Aug. 8, 1966). (In French).

The variation in energy losses undergone by 28.4-Mev electrons was studied as a function of the scattering angle in thin foils, some formed from monocrystalline layers with the faces normal to the 6-fold axis (beryllium) and others normal to the 3-fold axis (antimony). The variations observed were compared to those obtained under identical conditions for the same bodies formed from crystallites oriented in every direction. (tr-auth)

**45004** DYNAMIC POLARIZATION OF PROTONS IN $La_2Mg_3(NO_3)_{12}.24H_2O$ DOPED WITH $Dy^{3+}$. Odehnal, Milan (Centre d'Etudes Nucleaires, Saclay, France. Institut des Recherches Nucleaires, Rez, Czech.). Compt. Rend., Ser. B, 263: 481-4(Aug. 8, 1966). (In French).

The results are presented of the dynamic polarization of protons in $La_2Mg_3(NO_3)_{12} \cdot 24\ H_2O$ doped with $Dy^{3+}$ in a relatively low field. Polarizations on the order of 6% at 6 kOe and 37% at 12 kOe were obtained. (tr-auth)

**45005** HARDENING OF NaCl SINGLE CRYSTALS BY X RAYS. Perinova, M. (Inst. of Physics, Bratislava); Urusovskaja, A. A. Czech. J. Phys., 16: 791-6(1966).

The influence of x-ray irradiation and the following bleaching on microhardness and dislocation mobility was investigated. It was found that dislocations were pinned in irradiated samples and the pinning was not destroyed by illumination. The microhardness, increased by irradiation, increased still further by bleaching. (auth)

**45006** ABSORPTION, FLUORESCENCE, AND BLEACHING OF PURE AND ACTIVATED CADMIUM FLUORIDE CRYSTALS. Karras, Hans; Koetitz, Guenther; Lehmann, Rita; Luedke, Werner; Reimann, Rudolph (VEB Carl Zeiss, Jena, Ger.). Exp. Tech. Phys., 13: 326-36(1965). (In German).

Results on the absorption and fluorescence of nonactivated and activated crystals are reported. The effect of radiation on these properties was determined. The experimental results show that pure $CdF_2$ crystals can be bleached only slightly and without significant structure by x radiation. Crystals with poor uv permeability are strongly bleached, however. The $CdF_2$ crystals remain colorless after the additive bleaching method—heating in metallic vapor. Yttrium and the rare earths samarium, europium, ytterbium, and neodymium, can be introduced only in the trivalent state. X radiation cannot reduce the trivalent ions of the rare earths. (J.S.R.)

**45007** HIGH-SENSITIVITY MAGNETIC RESONANCE BY BOLOMETER DETECTION. Schmidt, J.; Solomon, I. (Ecole Polytechnique, Paris). J. Appl. Phys., 37: 3719-24(Sept. 1966).

It is shown that spin magnetic resonance can be observed by a rise in the temperature of the sample, with a sensitivity equal to or better than with the more conventional electromagnetic detection methods. An experimental demonstration is provided by a crude bolometer made of a thin copper wire with a small sample of DPPH glued in the center. A sensitivity of about $5 \times 10^{11}$ spins, for a detector bandwidth of 1 cps was obtained at room temperature. An important advantage is the absence of a microwave carrier signal, resulting in a very stable baseline and the possibility of using high microwave power. A detailed theoretical discussion shows that this method is well adapted for wide electronic lines, high frequency (up to 2-mm wavelength), low temperature, and small size samples. In favorable cases (resonance of conduction electrons in metals or semiconductors) a sensitivity of $10^6$ spins, at liquid-helium temperature, is predicted. (auth)

**45008** EFFECTS OF PRE-IRRADIATION ANNEALING ON THE THERMOLUMINESCENCE AND DIELECTRIC LOSS OF LiF:Mg. Grant, R. M. Jr.; Cameron, J. R. (Univ. of Wisconsin, Madison). J. Appl. Phys., 37: 3791-5(Sept. 1966).

The character of the radiation-induced thermoluminescent glow peaks in LiF : Mg (70 ppM and 100 ppM by spectrographic analysis) is affected by pre-irradiation isothermal annealing. For pre-irradiation annealing below 100°C the kinetics of one of the glow peaks, which appears at about 105°C, was correlated with the annealing kinetics of quenched-in $Mg^{++}$–cation vacancy complexes as measured by dielectric loss techniques. After the samples were annealed for one hour at 400°C and cooled in about 3 min to room temperature, almost all of the magnesium is found to be associated with cation vacancies. The 105°C glow peak associated with the $Mg^{++}$-cation vacancy complex is proportional to the measured number of these complexes in the two samples. (auth)

**45009** PRODUCTION OF DISORDERED REGIONS IN GERMANIUM BY ELECTRON IRRADIATION. Kalma, A. H. (Rensselaer Polytechnic Inst., Troy, N. Y.); Corelli, J. C.; Cleland, J. W. J. Appl. Phys., 37: 3913-15(Sept. 1966).

Data are reported from a series of experiments in which n- and p-type samples of Ge doped with As and Sb were irradiated with $^{60}$Co photons and 15- and 50-Mev electrons. The results indicate that high-energy electron irradiation of Ge can produce disordered regions or defect clusters that have a pronounced effect on the apparent energy level position of defect states. (A.G.W.)

**45010** ELECTRON SPIN RESONANCE ABSORPTION SPECTRUM OF THE $AsO_3^{2-}$ MOLECULE ION IN γ-IRRADIATED SINGLE-CRYSTAL CALCITE. Serway, R. A. (Illinois Inst. of Tech., Chicago); Marshall, S. A. J. Chem. Phys., 45: 2309-14(Sept. 15, 1966).

An axially symmetric ESR absorption spectrum consisting of four principal hyperfine-structure components was observed in γ-irradiated calcite single crystals. The symmetry axis of the spectrum is found to coincide with the crystal [111] direction, and at 77°K the spin-Hamiltonian parameters are given by $g_{||} = 2.00162$, $g_{\perp} = 2.00195$, $A_{||} = 2627.7$ Mc/sec, $A_{\perp} = 2108.8$ Mc/sec, eqQ = –2.4 Mc/sec, and $g^n\beta^n/g\beta = -0.00028$. From the hyperfine structure multiplicity and the ratio of moments, it is concluded that the paramagnetic center is associated with the 100% naturally abundant $^{75}$As nucleus. This spectrum is identified as being due to the $AsO_3^{2-}$ molecule ion, which occurs as a substitution for the $CO_3^{2-}$ molecule ion in calcite. (auth)

**45011** EFFECTS OF 2 AT. PERCENT RARE-EARTH ADDITIONS ON THE $\gamma \rightleftharpoons \alpha$ ELECTRONIC TRANSFORMATION OF CERIUM. Miner, W. N.; Elliott, R. O.; Clinard, F. W. (Los Alamos Scientific Lab., N. Mex.). J. Less-Common Metals, 11: 301-7(1966). (LA-DC-7566).

Individual additions of 2 at. % of the various trivalent rare earths to cerium were found, through electrical resistivity measurements, to lower both the $\gamma \rightarrow \alpha$ and $\alpha \rightarrow \gamma$ electronic transformation temperatures of cerium by about 20°K. Addition of a similar amount of divalent ytterbium caused the amount of lowering to be increased to about 40°K. The results for normally divalent europium suggest that it is divalent when dissolved in γ but is trivalent as a solute in α cerium. A slight trend toward higher $\gamma \rightleftharpoons \alpha$ transformation temperatures with higher atomic number of the trivalent rare-earth solute was observed and is attributed to the effect of size difference between the solvent cerium and the solute. (auth)

**45012** PHASE EQUILIBRIA AS RELATED TO CRYSTAL STRUCTURE IN THE SYSTEM NIOBIUM PENTOXIDE–TUNGSTEN TRIOXIDE. Roth, R. S.; Waring, J. L. (National Bureau of Standards, Washington, D. C.). J. Res. Nat. Bur. Stand., 70A: 281-303(July-Aug. 1966).

The phase equilibrium diagram for the binary system niobium pentoxide-tungsten trioxide was constructed from results of x-ray diffraction studies on both single crystals and powders and from fusion characteristics. Twelve stable compounds were found in the system. The exact composition of eight of these compounds was established by single crystal analyses at the $Nb_2O_5$ : $WO_3$ ratios of 6 : 1, 13 : 4, 7 : 3, 8 : 5, 9 : 8, 1 : 1, 4 : 9, and 2 : 7. The approximate compositions of the remaining four other phases were 30 : 1, 6 : 11, 1 : 11, and 1 : 15. The 6 : 1, "6 : 11," 4 : 9, and 2 : 7 phases melt congruently at 1476, 1378, 1380, and 1357°C, respectively. The "30 : 1," 7 : 3, 8 : 5, 9 : 8, "1 : 11," and "1 : 15" phases melt incongruently at 1470, 1440, 1385, 1375, 1356, and 1358°C, respectively; and the 13 : 4 and 1 : 1 phases decompose before melting at 1435 and 1115°C, respectively. The 8 : 5, 9 : 8, "6 : 11," 2 : 7, "1 : 11," and "1 : 15" compounds are shown on the phase diagram as having minimum temperatures of stability. One metastable phase having a narrow range of composition near the 3 : 8 ratio was also encountered. Although $Nb_2O_5$ apparently exhibits no solid solution, $WO_3$ was found to accept a maximum of three mole percent niobia in solid solution enabling all the reported polymorphs of $WO_3$ to be obtained at room temperature. (auth)

**45013** NEUTRON POWDER DIFFRACTOMETRY USING A WAVELENGTH OF 2.6 A. Loopstra, B. O. (Reactor Centrum Nederland, Petten, Netherlands). Nucl. Instrum. Methods, 44: 181-7(Oct. 1966).

Consideration of the resolution of neutron powder diffractometers as a function of the wavelength shows that an increase in overall resolution results from increasing the wavelength at a constant value of the lattice spacing of the monochromator crystal. When a wavelength of 2.6 Å is selected, the higher-order contamination problems can be eliminated by means of a filter of pyrolytic graphite. It is calculated that at this wavelength the intensity will be higher than for wavelengths in the usual range, assuming equal resolution. Experimental results confirming these calculations are given. (auth)

**45014** THE EFFECTS OF SYSTEMATIC REFLECTIONS ON MEASUREMENTS OF THE EXTINCTION DISTANCE AND THE ABSORPTION OF HIGH-ENERGY ELECTRONS IN CRYSTALS. Goringe, M. J.; Howie, A.; Whelan, M. J. (Cambridge Univ., Eng.). Phil. Mag. (8), 14: 217-22(Aug. 1966).

Recent experiments on the energy dependence of the extinction distance and mean absorption coefficient of electrons in magnesium oxide crystals by Dupouy et al. (1965) have shown significant deviations from the relativistic two-beam dynamical theory of electron diffraction. It is shown that if systematic reflections, which are inevitably present in any experiment, are taken into account the experimental results are in accord with many-beam dynamical theory. (auth)

**45015** RAMAN SCATTERING IN URANIUM DIOXIDE. Marlow, P. G. (Royal Radar Establishment, Malvern, Eng.); Russell, J. P.; Hardy, J. R. Phil. Mag. (8), 14: 409-10(Aug. 1966).

The first-order Raman effect in uranium dioxide was measured using a backward-scattering technique. The value obtained for the triply degenerate, $\Gamma_{25}^{+}$ mode, agrees well with that from neutron scattering data. (auth)

**45016** CHANNELLING OF PROTONS IN IONIC SOLIDS. Nelson, R. S. (Atomic Energy Research Establishment, Harwell, Eng.). Phil. Mag. (8), 14: 637-45 (Sept. 1966). (AERE-R-5176).

The theoretical aspects of the channelling of protons in the simple ionic solids of the rock-salt and cesium chloride structures are discussed. It is shown that the electrostatic fields occurring between the constituent positive and negative ions can affect the trajectories of protons travelling along certain crystal directions. In particular, the ions surrounding the ⟨100⟩ direction of the rock-salt structure form a series of electrostatic quadrupole lenses which constrain the proton's path to the central region of the channel. This quadrupole effect is compared to the channelling produced by the interaction with the exponentially screened Coulomb potential of the nuclei, and is shown to be significant only at relatively low proton energies below 10 kev. (auth)

**45017** ION BOMBARDMENT OF GLASS. **Carter, G.; Grant, W. A. (Univ. of Liverpool). Phys. Chem. Glasses, 7: 94-100(June 1966).**

In this review, with 46 references, the effects produced by the bombardment of glass surfaces by energetic ions are surveyed. Data for $H^+$, $H_2^+$, $H_3^+$, $He^+$, $Ne^+$, $Ar^+$, $Kr^+$, and $Xe^+$ accelerated at energies up to 30 kev are examined in particular. It is seen that these ions can penetrate glass and become embedded, frequently requiring considerable thermal energy for their subsequent release from sites conditioned, both by the heterogeneity of the glass and by rearrangement processes induced by the irradiation. Comparisons of theoretical estimates of the ion penetration depths, and the defect production with the experimental evidence, are in reasonable agreement when the ion-atom collisions are assumed to be of the randomized nature expected in a structure such as glass. Evidence for thermal spikes is found in damage measurements and also in high energy sputtering measurements, while low energy sputtering data tend to confirm current concepts that the crystalline structure of the target is of relatively minor importance but that the density of near surface collisions is dominant. The enhanced secondary emission processes from glass can be explained on the basis of the ejection of bound electrons which do not suffer the scattering collisions with conduction electrons which occur in metals. The other phenomena discussed are all known to increase in importance with increasing ion energy and decreasing glass temperature, and so the provision of a conducting coating, held at a high positive potential can also minimize these effects. Maintenance of the glass at as high a temperature as possible can also be useful, since this minimizes ion trapping and allows damage annealing while at the same time making the glass semiconducting. (BBB)

**45018** ELECTRON DAMAGE ORIENTATION EFFECTS IN SILICON SOLAR CELLS. **Grimshaw, J. A. (J. J. Thompson Physical Lab., Reading, Eng.). Phys. Lett., 22: 372-4(Sept. 1, 1966).**

The orientation and energy dependence of damage rate in n and p-type Si solar cells, measured from changes in bombarding electron-stimulated short circuit current, indicates that the minimum displacement energy is about 12 ev and in the ⟨111⟩. (auth)

**45019** ORIENTATION DEPENDENCE OF THE EMISSION OF POSITRONS AND ELECTRONS FROM $^{64}$Cu EMBEDDED IN SINGLE CRYSTALS. **Uggerhoej, E. (Univ., Aarhus, Denmark). Phys. Lett., 22: 382-3(Sept. 1, 1966).**

The influence of atomic strings on the motion through a single crystal of positrons and electrons was investigated, showing a pronounced dip and peak in yield, respectively, in the axis direction. (auth)

**45020** COHERENT BREMSSTRAHLUNG RADIATION OF 15-Mev ELECTRONS IN A SILICON MONOCRYSTAL. **Grachyov, B. D.; Komar, A. P.; Korobochko, Yu. S.; Mineev, V. I.; Vinnichenko, A. E. (Polytechnical Inst., Leningrad). Phys. Lett., 22: 498-500(Sept. 1, 1966).**

The bremsstrahlung spectrum of electrons from a single-crystal target differs from the Bethe-Heitler spectrum. The difference consists in the presence of peaks superimposed on a continuum, the former due to the interaction of electrons with low harmonics of the lattice potential not degraded by thermal motion. An attempt was made to detect such coherent bremsstrahlung radiation of electrons at 15 Mev from a silicon single crystal. Data are presented for the scintillation spectrum with the (111) plane of the silicon crystal perpendicular to the electron beam, and with the crystal turned over 15°. (S.F.L.)

**45021** COUPLING BETWEEN FERROMAGNETS THROUGH A SUPERCONDUCTING LAYER. **De Gennes, P. G. (Univ. Central de Venezuela, Caracas). Phys. Lett., 23: 10-11(Oct. 3, 1966).**

A superconducting film S of thickness smaller than one coherence length was placed between two layers of ferromagnetic insulators (of respective magnetizations $M_1$, $M_2$). $M_1$ and $M_2$ are then coupled, the antiparallel configuration being lower in energy. The magnitude of the coupling can be made comparable to the condensation energy of S. (auth)

**45022** FORMATION OF CHANNELING PATTERNS ON THE SURFACE OF ION BOMBARDED SILICON. **Nelson, R. S.; Mazey, D. J.; Matthews, M. D.; Holloway, D. F. (Atomic Energy Research Establishment, Harwell, Eng.). Phys. Lett., 23: 18-19(Oct. 3, 1966). (AERE-M-1783).**

During ion bombardment, crystalline silicon turns "amorphous" to a depth roughly equal to the range of the incident ion. An experiment is described which was specifically designed to study the influence of channeling of the incident ions on the formation of this "amorphous" phase. (auth)

**45023** ACOUSTIC NUCLEAR SPIN RESONANCE IN METALS. **Quinn, J. J.; Ying, S. C. (Brown Univ., Providence). Phys. Lett., 23: 61-2(Oct. 3, 1966).**

The propagation of transverse acoustic waves in metals parallel to a strong d-c magnetic field is studied. The attenuation of the acoustic wave via magnetic dipole coupling to the nuclear spins is evaluated. (auth)

**45024** DYNAMIC POLARIZATION OF PROTONS IN RADIATION-DAMAGED POLYETHYLENE BY THE SOLID EFFECT. **Hill, D. A.; Hasher, B. A.; Hwang, C. F. (Northwestern Univ., Evanston, Ill.). Phys. Lett., 23: 63-4(Oct. 3, 1966).**

Dynamic polarization of protons in irradiated polyethylene was measured at $H_0$ = 3 kG, 25 kG; T = 4.2°K, 1.2°K. Best result showed 10% free proton polarization. Center concentrations, epr linewidth, $T_{1e}$, and $T_{1p}$ were measured whenever possible. Results are compared to Jeffries' model. (auth)

**45025** STRESS EFFECTS ON 9572 cm$^{-1}$ LINE IN IRRADIATED MgO. **Stettler, J. D.; Shatas, R. A.; Tanton, G. A. (Physical Sciences Lab., Redstone Arsenal, Ala.). Phys. Lett., 23: 70-2(Oct. 3, 1966).**

Piezospectroscopic analysis of the 9572 cm$^{-1}$ zero-phonon line in neutron-irradiated MgO yields rhombic I center symmetry. Stress data are used to calculate the associated one-phonon spectrum in the Debye region in good agreement with spectroscopic observations. (auth)

**45026** TEMPERATURE VARIATION OF $^{139}$La NUCLEAR QUADRUPOLE RESONANCE IN LaF$_3$. **Lee, K. (Varian Associates, Palo Alto, Calif.); Sher, A.; Andersson, L. O.; Proctor, W. G. Phys. Rev., 150: 168-74(Oct. 7, 1966).**

The temperature dependence of the pure quadrupole transitions of $^{139}$La in LaF$_3$ was studied from 88 to 447°K. $^{139}$La has a nuclear spin of $^7/_2$, so three $|\Delta m| = 1$ transitions were observed. A spectrometer of crossed-coil geometry was used. The Bayer torsional-motion mechanism and an Einstein phonon spectrum are used to interpret the measurements. The characteristic (or Einstein) temperatures are 465 and 641°K. Values for the quadrupole coupling constant, asymmetry parameter, and electric-field-gradient components at the La sites are tabulated. The observed temperature variation is approximately two orders of magnitude larger than predicted by the simple theory employed. Mechanisms are discussed to account for this discrepancy. (auth)

**45027** DETERMINATION OF THE SIGN OF THE INTERACTIONS BETWEEN PAIRS OF Nd$^{3+}$ IONS IN LaCl$_3$ BY ELECTRON PARAMAGNETIC RESONANCE. **Baker, J. M.; Riley, J. D.; Shore, R. G. (Oxford Univ.). Phys. Rev., 150: 198-9(Oct. 7, 1966).**

Measurements of the interactions between nearest-neighbor (nn) and next-nearest-neighbor (nnn) Nd$^{3+}$ ions in LaCl$_3$ from the electron-paramagnetic-resonance (EPR) pair spectra are described, which are very similar to those recently reported by Brower et al. These numerical values are in substantial agreement with those of these authors, but by working at much higher frequency it was possible to determine the signs of the interactions. The signs are opposite to those assumed by Brower et al., and this considerably alters the interpretation of the nondipolar part of the interaction. In contrast to the suggestion made by Einstein et al., which was apparently confirmed by Brower et al., this part of the interaction cannot be described for nnn by an isotropic exchange between real spins, or for nn by a ferromagnetic isotropic exchange between real spins. (auth)

**45028** MEASUREMENT OF THE MEAN ENERGY REQUIRED TO CREATE AN ELECTRON-HOLE PAIR IN SILICON BETWEEN 6 AND 77 DEG K. Dodge, W. R.; Domen, S. R.; Leedy, T. F.; Skopik, D. M. (National Bureau of Standards, Washington, D. C.). Phys. Rev. Lett., 17: 653-5(Sept. 19, 1966).

The measurement of the mean energy required to create an electron hole pair with $^{207}$Bi conversion electrons at 20°K in lithium-compensated silicon as a function of temperature is repeated because of disagreement among previous results. The relative values of the product of the charge collection efficiency and the electronic charge are given for 480-kev $^{207}$Bi conversion electrons as a function of the reciprocal of the bias voltage. The mean energy required to create an electron-hole pair normalized to the average value in the temperature interval 6 to 77°K is shown. (J.F.P.)

**45029** $F_3^+$ CENTER IN NaF. Stiles, L. F. Jr.; Fitchen, D. B. (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Lett., 17: 689-91(Sept. 26, 1966).

Stress splitting and polarization of the 5456-Å zero-phonon line in irradiated NaF suggest that this line and its mirror absorption and emission bands are due to the predicted $^1A_1 \leftrightarrow {}^1E$ transition of the $F_3^+$ center. (auth)

**45030** SOME NOTES ON THE STRENGTHENING MECHANISM IN NEUTRON-IRRADIATED COPPER SINGLE CRYSTALS. Koppenaal, T. J. (Argonne National Lab., Ill.); Arsenault, R. J. Phys. Status Solidi, 17: 27-33(Sept. 1, 1966). (ORNL-P-2216).

Discussions are presented in some of the controversial areas regarding the interpretation of the strengthening mechanism in neutron-irradiated copper single crystals. The specific topics discussed include the following: the correlation of cross-head speed changes to strain rate changes, the strain rate dependence of the flow stress, the temperature dependence of the pre-exponential factor, the free energy and the enthalpy of activation, the defect and obstacle size spectrum, and the nature of the force-distance behavior for the interaction of mobile dislocations with irradiation-produced obstacles. It is shown that many of the recent arguments made against a previously published explanation of the strengthening mechanism can be readily explained without changing the interpretation. (auth)

**45031** ON THE STRENGTHENING MECHANISM IN NEUTRON-IRRADIATED COPPER SINGLE CRYSTALS. I. ON EXPERIMENTS CONCERNING STRAIN RATE CHANGES. Schwink, Ch.; Neuhaeuser, H. (Univ., Munich). Phys. Status Solidi, 17: 35-42(Sept. 1, 1966).

Strain rate changes are used for analyzing the flow stress of n-irradiated copper crystals and lead to the following conclusions: (a) The "active crystal length," i.e., the number of simultaneously active slip planes, increases with the strain rate $\dot{\gamma}$, resulting in $\dot{\gamma}$ not being proportional to $\dot{l}$ (cross-head speed). (b) The critical shear stress varies with $\dot{l}$ more rapidly than is expected from theory. The proportionality $\dot{\gamma} \sim \dot{l}$ is shown to represent a rather special case from an atomic point of view. By far more general is a non-proportionality $\dot{\gamma} \sim \dot{l}$. Taking this into account one succeeds in describing straightforwardly the results of (b). New experiments supporting former statements are to be reported. All conclusions drawn previously on the strengthening mechanism in copper and based on (a) and (b) can be fully maintained. (auth)

**45032** ON THE STRENGTHENING MECHANISM IN NEUTRON-IRRADIATED COPPER SINGLE CRYSTALS. II. ANALYSIS OF THE THERMALLY ACTIVATED PROCESSES. Diehl, J.; Seidel, G. P. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Phys. Status Solidi, 17: 43-8(Sept. 1, 1966).

Koppenaal's and Arsenault's analysis of the thermally activated glide processes in neutron-irradiated copper is discussed and compared with a similar investigation of the present authors. It is shown that Koppenaal and Arsenault use a number of very restrictive and not very realistic assumptions, e.g., regarding the behavior of the dislocations and the nature of the dislocation obstacles. Koppenaal's and Arsenault's arguments can be refuted. (auth)

**45033** MAGNETIC HYPERFINE STRUCTURE OF THE $^{57}$Fe IMPURITY NUCLEUS IN NON-MAGNETIC MATERIALS. Bara, J. (Jagiellonian Univ., Krakow); Hrynkiewicz, H. U.; Hrynkiewicz, A. Z.; Karapandzic, M.; Matlak, T. Phys. Status Solidi, 17: K53-5(Sept. 1, 1966).

Carrier-free $^{57}$Co evaporated on an Al foil was heated in an Ar atmosphere. Absorption spectra were measured at room temperature in a stainless steel absorber after heating for 100, 200, and 400 min at 873°C. The longer heating times produced drastic changes in the Mössbauer spectrum. Investigation of the temperature dependence of the effective magnetic field acting on a $^{57}$Fe nucleus at temperatures of 78 to 523°K showed a very slow decrease in the magnetic hyperfine coupling strength with increasing temperature. In the temperature range 533 to 573°K the Zeeman pattern gradually disappeared. (A.G.W.)

**45034** SHIFT OF TRANSFORMATION POINTS BETWEEN CRYSTALLINE PHASES THROUGH LATTICE DEFECTS. Balarin, M.; Schenk, M. (Deutsche Akademie der Wissenschaften, Berlin. Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Phys. Status Solidi, 17: 91-9(Sept. 1, 1966). (In German).

The shift of the phase transformation points in polymorphic solids due to small concentrations of irradiation-induced crystal defects is calculated thermodynamically. For high defect concentrations irradiation-induced phase transformations are possible. For barium titanate the theoretical conclusions are compared with the observed neutron-irradiation-induced shift of the Curie point and the final phase transformation tetragonal → cubic. The experimental results agree satisfactorily with the theory. (auth)

**45035** ZERO-PHONON LINES OF COLOR CENTERS IN LiF AND NaF. Kazumata, Y.; Kamikawa, T.; Ozawa, K. (Japan Atomic Energy Research Inst., Tokyo). Phys. Status Solidi, 17: 131-8(Sept. 1, 1966).

The optical absorption of LiF and NaF irradiated by electrons or neutrons is measured at liquid He temperature and above. In these crystals zero-phonon lines are observed on the F-aggregate centers. From the temperature dependence of the relative intensities of zero-phonon lines and broad bands, Debye temperatures are deduced using the Debye approximation, and the semi-local mode approximation based on the Debye model. Debye temperatures obtained by this method are different in each F-aggregate center. The coupling between the trapped electrons in the lattice defects and the lattice waves is discussed and interpreted in terms of both the local and normal modes. (auth)

**45036** OPTICAL AND THERMAL PROPERTIES OF COLOR CENTERS IN CsBr SINGLE CRYSTALS IRRADIATED AT LIQUID-HELIUM TEMPERATURE. Van de Wiele, F.; Jacobs, G. (Laboratorium voor Kristallografie en Studie van Vaste Stoffen, Ghent). Phys. Status Solidi, 17: 177-84(Sept. 1, 1966).

Absorption bands at 435 and 437 nm, induced in CsBr single crystals by x irradiation at liquid-helium temperature, are interpreted as being due to H centers. Underlying bands are observed in the region of the F absorption band. Optical and thermal interactions between the F and V type and $\alpha$ bands are shown to be present and mechanisms for these interactions are proposed. The formation of a new absorption band at 320 nm during the thermal bleaching is observed. Some optical and thermal properties of this band are examined. (auth)

**45037** STORED ENERGY, VOLUME, AND RESISTIVITY CHANGE IN NEUTRON-IRRADIATED ALUMINIUM. Isebeck, K.; Rau, F.; Schilling, W.; Sonnenberg, K.; Tischer, P.; Wenzl, H. (Technische Hochschule, Munich). Phys. Status Solidi, 17: 259-68(Sept. 1, 1966).

Pure aluminum samples are irradiated at 4°K in the core of the Munich Research Reactor. Measurements are then made of the release of the stored energy ($\Delta Q$) and the changes in the length ($\Delta l$) and electrical resistivity ($\Delta\rho$) during annealing between 4 and 300°K. For the first annealing stage, observed between 4 and 55°K, these measurements yield $\Delta Q/\Delta\rho = 38.3 \pm 1.3$ Ws/g$\mu\Omega$ cm, $(\Delta l/l)/\Delta\rho = 0.12 \pm 0.005$ %/$\mu\Omega$ cm. The corresponding ratios for the two other observed stages have similar values. The experimental results suggest the following values for specific properties of defects in aluminum ($E_F$, $E_i$, $E_v$ being the energies of a Frenkel defect, an interstitial, and a vacancy, respectively; $V_F$ is the volume change per Frenkel defect; $\rho_F$, $\rho_i$, $\rho_v$ are the resistivity changes per unit concentration of Frenkel defects, interstitials, and vacancies, respectively): $E_F = 3.4$ ev; $E_v = 0.8$ ev; $E_i = 2.6$ ev; $V_F = 1.2$ atom vol; $\rho_F = 340$ $\mu\Omega$ cm; $\rho_v = 220$ $\mu\Omega$ cm; $\rho_i = 120$ $\mu\Omega$ cm. (auth)

**45038** STUDY OF THE DECAYS OF VACANCY AGGLOMERATES IN NEUTRON-IRRADIATED NICKEL BY MEANS OF CRITICAL SHEARING STRESS. Ast, D.; Diehl, J. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Phys. Status Solidi, 17: 269-84(Sept. 1, 1966). (In German).

The annealing of the critical shear stress of nickel single crystals is investigated after irradiation fast neutrons at 80°C. The vacancy agglomerates ("depleted zones") responsible for the enhancement of the critical shear stress are found to anneal out at about 400°C via a first order reaction with an activation energy of 2.28 ev. The results can be interpreted by assuming that the agglomerates decompose by the splitting-off of single or multiple vacancies. The annealing rate is then determined by the first splitting-off process initiating complete disintegration. Calculations of the stability of possible vacancy agglomerate configurations indicate that the depleted zones are probably Frank or R-dislocation loops containing approximately ten vacancies. Before the beginning of the main annealing stage a broad annealing band is observed, which can be explained by the recombination of impurity-trapped interstitial atoms with the vacancy agglomerates. (auth)

**45039** STUDY OF POINT DEFECTS PRODUCED BY NEUTRON BOMBARDMENT IN IRON CONTAINING CERTAIN IMPURITIES. Vigier, P.; Minier-Cassayre, C.; Moser, P.; Hivert, V. (Centre d'Etudes Nucleaires, Grenoble, France). Phys. Status Solidi, 17: 317-21(Sept. 1, 1966). (In French).

Point defects produced in doped iron by neutron irradiation at 77°K are studied. The simultaneous measurement of the reorientation and total concentration of these defects shows that an agglomeration process for elementary defects exists in stages I and II. (auth)

**45040** INTERPRETATION OF RECOVERY STAGES IN IRRADIATED METALS. von Jan, R. (Atomic Energy Research Establishment, Harwell, Eng. Max-Planck-Institut fuer Metallforschung, Stuttgart). Phys. Status Solidi, 17: 361-73(Sept. 1, 1966).

Recent experiments suggest that in stages I and II bound Frenkel pairs only anneal. Such an interpretation leads to the following model: a vacancy and an interstitial form a bound Frenkel pair when their separation is less than about 10 lattice constants. The pairs that anneal above stage I are produced by multiple displacements or focused replacement sequences, and all pairs arising from defocused single displacements anneal in stage I. Secondary pairs (with partners from different damage events) produce effects similar to those expected from a freely migrating interstitial. A consistent interpretation of the recovery in Au, Cu, and Al can be given in this way. (auth)

**45041** RADIATION-INDUCED COLORS IN DEFORMED ALKALI-HALIDE CRYSTALS. Melik-Gaikazyan, I. Ya.; Roshchina, L. I.; Ignat'eva, M. I. (Tomsk Polytechnical Inst., USSR). Soviet Phys.-Cryst. (Engl. Transl.), 11: 287-8(Sept.-Oct. 1966).

Translated from Kristallografiya, 11: 320-2(Mar.-Apr. 1966).

Buildup of F centers in KCl and KCl + Sr crystals was measured after uniaxial compression following previous x irradiation for 20 hr. Comparison with similar measurements on undeformed x-irradiated crystals indicated that deformation produces additional vacancies. Measurements showed that electric conductivity in the range 50 to 150°C is reduced for deformed KCl, the reduction being linearly related to the deformation; the number of free cation vacancies must, therefore, be reduced. This decrease is eliminated by treatment at 200 to 300°C. The fall in conductivity of deformed KCl + Sr is reduced at the higher Sr contents. (A.G.W.)

**45042** LONG-WAVELENGTH EXCITATIONS AND THE GOLDSTONE THEOREM IN MANY-PARTICLE SYSTEMS WITH "BROKEN SYMMETRIES". Wagner, Herbert (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Z. Phys., 195: 273-99(1966).

Long-wavelength excitations in ferro-, antiferromagnets, superfluids, and crystals are studied in connection with the nonrelativistic Goldstone theorem. It is shown that, except in the example of superfluids, the statement of "broken symmetry" together with the local conservation laws implies the existence of gapless excitations in the limit of vanishing momenta (magnons, phonons). For this purpose a generalized version of Bogoliubov's $1/k^2$-theorem is derived. This theorem yields long-range order in certain correlation-functions which are specific for condensed systems with broken symmetry. It is stressed that the long-wavelength density-excitation spectra in quantum liquids are insensitive to whether gage symmetry is broken or not. They are controlled by the range of the interaction-potential. Therefore these density-excitations do not necessarily provide an argument pro and contra the nonrelativistic Goldstone theorem. (auth)

**45043** CRYSTAL STRUCTURE OF TERBIUM AT 120 TO 300 DEG K. Finkel, V. A.; Smirnov, Yu. N.; Vorob'ev, V. V. (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Zh. Eksp. Teor. Fiz., 51: 32-7(July 1966). (In Russian).

The crystal structure of terbium at temperatures between 120 and 300°K is studied by a low temperature x-ray pattern method. It is shown that at 234°K a $\lambda$ anomaly of the linear expansion coefficients occurs which is due to transition of paramagnetic terbium to the antiferromagnetic state. At 223°K a sharp change in the atomic volume is observed. This signifies that the transformation of the antiferromagnetic helicoidal structure to a ferromagnetic one (with collinear ordering) is a phase transition of the first kind. A weak rhombic distortion of the hexagonal crystal, lattice of terbium occurs below 223°K. (auth)

**45044** INTERNATIONAL SYMPOSIUM ON LUMINESCENCE. THE PHYSICS AND CHEMISTRY OF SCINTILLATORS. SEPTEMBER 5-9, 1965, MUNICH, GERMANY. Riehl, N.; Kallman, H.; Vogel, H. (eds.). Munich, Verlag Karl Thiemig KG, 1966. 484p. DM 68.-. (In German, English, and French). (CONF-650951).

Sixty-six reports and short papers presented at the Symposium on Luminescence are included under the following topics: energy-transfer processes in scintillators; decay times of scintillators; physics and chemistry of organic phosphors, radiation damage to phosphors; alkali and alkali halide scintillators; inorganic phosphors; and sulfide and oxide phosphors. (L.B.S.)

# REACTOR TECHNOLOGY

## General

*Refer also to abstracts 43635 and 43829.*

**45045** (BMI-X-10173) FISSION-PRODUCT DEPOSITION AND ITS ENHANCEMENT UNDER REACTOR ACCIDENT CONDITIONS. Quarterly Progress Report, April–June 1966. Morrison, David L.; Berry, David A.; Berry, Warren E.; Genco, Joseph M. (Battelle Memorial Inst., Columbus, Ohio). July 1, 1966. Contract W-7405-eng-92. 37p. (EURAEC–1708). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Work Performed under United States–Euratom Joint Research and Development Program.

Progress is reported in the performance of experimental and analytical work on the chemical and physical processes which affect $I_2$ transport and deposition and the development of coatings which would retain the fission-product $I_2$ released in the event of a serious accident in a water-cooled reactor. The kinetic behavior of $I_2$ and its fission product precursors is studied for both containment- and primary-system surfaces. Variables examined are $I_2$ form and concentration, condensation rate, type of surface, atmosphere, gas flow rate, temperature, pressure, and the influence of Te. Analytical studies are performed on surface reactions and deposition, gas-phase mass transport, and homogeneous gas-phase reactions. Polymer films and reactive pigments in conventional coatings are examined for their ability to adsorb and retain I, HI, and $CH_3I$ in the vapor state. (H.D.R.)

**45046** (IDO–17192) NUCLEAR TECHNOLOGY BRANCHES QUARTERLY REPORT, JANUARY 1–MARCH 31, 1966. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Aug. 1966. Contract AT(10-1)-205. 53p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

The power distribution was measured in the ATR 39-kg core in a nominal 50-50-50 power split in the ATRC. Thermal flux and fission rate data were obtained in experiment irradiation holes. Extrapolated hot-spot power generation would be 26.2 Mw/kg at 250 Mw. Reactivity worths and calibration curves of outer shims and regulating rods in this core are presented. Be irradiated at 600°C to exposures of approximately $1 \times 10^{21}$ n/cm$^2$ > 1 Mev was compression tested, and the He gas release was measured. The failure mechanism was noted, and electron fractographs of the gas bubble formation are given. The procedures used for the preparation of Resonance Integral Measurement Samples are described. These involve the use of powder metallurgical techniques to produce tubular specimens containing rare earth oxides dispersed in Al. Electroless Ni-coated 6061 Al samples were corrosion tested in a pressurized water loop at 190°C and 45 ft/sec. Various heat treatments were studied. The best corrosion resistance was produced by a 54-hour, 410°C air heat treatment. Results of analysis of the structural behavior of the ATR fuel element from the thermal differences present during operation are described. Selective loading of the fuel in ATR fuel elements to decrease the beginning-of-life temperatures is examined. The results of the thermal and structural calculations for one radially variable fuel element are compared to the reference design. The energy of the hydrogen-neutron-capture gamma ray was measured, using a Li-drifted Ge detector, to be 2223.29 ± 0.07 kev. Based upon this result, the binding energy of the deuteron was determined to be 2224.61 ± 0.07 kev. The energy levels in $^{149}$Sm were studied by means of the radioactive decay of $^{149}$Pm and $^{149}$Eu. Gamma-ray and conversion-electron spectra were obtained along with gamma-gamma coincidence spectra. All 39 gamma-ray transitions observed in these two activities were placed in schemes with levels in $^{149}$Sm at 22.5, 277.0, 285.9, 350.0, 528.5, 558.4, 590.9, 636.4, 830.4, 833.2, and 881.9 kev. (auth)

**45047** (NAA-SR-12041) INITIAL EXPERIENCE WITH LARGE SODIUM FIRES EXPERIMENTS (LF-1). Lauben, G. N. (Atomics International, Canoga Park, Calif.). Aug. 1, 1966. Contract AT(11-1)-Gen-8. 40p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

In the safeguards analysis of Na-cooled reactors, a serious dispersion of radioactivity is potulated to result from a large primary coolant (Na) fire in a gallery or vault. In order to evaluate and/or mitigate this dispersion, it is necessary to determine the effects of time, initial-condition variables, and system parameters on: (1) the spatial distribution of energy; (2) the amount of Na released (presumably as $Na_2O$); and (3) the amount of selected fission products released. Reported herein are the results of an investigation, including results of a fire, in which the geometric and convective conditions which might be found in a reactor gallery or vault were simulated. Before ignition, a 2-ft diameter burn pot was charged with 615 lb of Na seeded with ~6400 $\mu$C of I-131 and heated to 350°F in an inert atmosphere. The fire burned for 32 hours at an average rate of about 6 lb/hr-ft$^2$. The release rate of Na as $Na_2O$ was about 2 lb/hr-ft$^2$ for 26 hr, after which the remainder of the oxide, which was building up from the bottom of the pot, penetrated the surface and formed a hard crust which cut off smoke generation. A material balance accounted for 94% of the Na and 77% of the $I_2$; 67% of the Na remained as residue in the pot and 27% was released, 69% of the I-131 remained in the residue and 8% was released. (auth)

**45048** (ORNL-P-2311) OPTIMIZATION OF REACTOR SHUTDOWN MARGIN MEASUREMENTS IN HIGH GAMMA FLUXES. Roux, D. P. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 5p. (CONF-661001-18). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

For Presentation at 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

An equation is derived to quantitatively predict the degrading effect of gamma background from fission products on the quality of reactor shutdown margin measurements made by neutron noise analysis. Ionization chamber characteristics were optimized using the results of this analysis. (H.D.R.)

**45049** (ORNL-P-2431) REMOVAL OF RADIOACTIVE METHYL IODIDE FROM STEAM-AIR SYSTEMS. Ackley, R. D.; Adams, R. E.; Browning, W. E. Jr. (Oak Ridge National Lab., Tenn.). [1965]. Contract W-7405-eng-26. 21p. (CONF-660904-7). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From 9th Air Cleaning Conference, Boston, Mass.

Methyl iodide trapping from an air stream under conditions of high relative humidity and increased temperature and pressure postulated for a reactor accident is investigated in a series of tests on impregnated activated charcoals. Results are presented on removal efficiencies for two charcoal varieties impregnated with iodine-containing substances and for one variety impregnated with triethylenediamine. The tests confirmed previous findings that the methyl iodide trapping efficiency decreases as relative humidity increases. (H.D.R.)

**45050** (ORNL-TM-1260) HEATING IN INFINITE CYLINDERS BY UNIFORM GAMMA SOURCES. Nestor, C. W. Jr.; Claiborne, H. C. (Oak Ridge National Lab., Tenn.). Aug. 15, 1966. Contract W-7405-eng-26. 33p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

As an aid to the reactor designer concerned with gamma heating in elements that may be approximated by long cylinders, the point kernel describing the transfer of gamma energy for the case of sources distributed uniformly throughout a right circular cylinder of infinite length is integrated. Since the coefficients were available for a third-degree polynomial representation of the energy absorption buildup factor for several materials, this representation was chosen and the solution was reduced to a single numerical integration for each term in the buildup factor expansion. In addition, an analytical expression for the contribution from the linear term in the expansion was obtained. The reduction of the solution to a single integration, the derivation of the analytical expression for the linear term contribution, and the numerical integration procedure are described. The results of the calculations are given in tabular and graphical form, and listings of the FORTRAN-63 programs are included for reference. (auth)

**45051** (RISO–125) COOLANT MIXING IN MULTIROD FUEL BUNDLES. Moyer, Carl B. (Danish Atomic Energy Commission, Risoe. Research Establishment). July 1964. 37p. Dep. mn. Danish Atomic Energy Commission, Risoe, Denmark.

Available experimental data in the literature on mixing rates between sub-channels for axial flow in multirod fuel bundle assemblies both with and without mixing promoters are gathered together. The data are compared to mixing rates predicted by various methods. The data for mixing around bare rods, without mixing promoters, is somewhat erratic and hard to predict within a factor of 3. Mixing with fins or wire wraps, however, seems more systematic and easier to predict. In the range of data available, predictions seem to be as good as ±50%. (auth)

**45052** (TID–8200(14th Rev.)) NUCLEAR REACTORS BUILT, BEING BUILT, OR PLANNED IN THE UNITED STATES AS OF JUNE 30, 1966. (Office of the Assistant General Manager for Reactors (AEC), Washington, D. C.). 31p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Information is tabulated on name, owner, location, principal contractor, type, power, and operating dates for United States facilities capable of sustaining a nuclear chain reaction. The reactors are categorized by primary function, including civilian reactors, military reactors, production reactors, reactors for export, and critical assembly facilities. (H.D.R.)

**45053** CORRELATION OF NEUTRONS IN NUCLEAR REACTORS CONSIDERING SPACE AND ENERGY DISTRIBUTION. Kozik, B. At. Energ. (USSR), 20: 473-8 (June 1966). (In Russian).

The correlation theory of neutrons in nuclear reactors is extended to the case of space and energy dependence of neutron distribution. The basic theory applies the proven fact that the binary density of the correlations satisfy equations similar to the Green functions of the non-stationary Boltzmann equation. In the stationary case the correlation theory leads to the theory of Green functions and perhaps it can easily be connected with the conception of transmission functions. Precise expressions of the binary spectral density of the power of the apparent source of the reactor noise, greatly dependent on the frequency, were obtained. (tr-auth)

**45054** SELECTION AND SAFETY EVALUATION OF REACTOR SITES. Kellermann, O.; Franzen, L. F. (Technische Ueberwachungsvereine eV, Cologne). Atomwirtschaft, 11: 380-4(July 1966). (In German).

A comparison of the accidental doses and site criteria for nuclear reactors in the various countries shows that the present knowledge is not sufficient to formulate mutually satisfactory regulations. In the German Republic there are no site criteria comparable to those in the American, British, or Canadian regulations. (J.S.R.)

**45055** COUNTING, SIZING, AND SAMPLING OF AITKEN NUCLEI IN GAS-COOLED REACTORS. Megaw, W. J.; Wiffen, R. D. (Atomic Energy Research Establishment, Harwell, Eng.). J. Nucl. Energy: Pt. A and B, 20: 521-36(July 1966). (AERE-R-5120).

Methods of counting and sizing Aitken nuclei are described and their application to pressurized gas-cooled reactors discussed. It is concluded that the most satisfactory instrument at present available for determining concentrations of Aitken nuclei in reactors is the Nolan-Pollak counter. A method is given of estimating the percentage release of gas-borne particulate fission products through a specified leak by measuring the rate of disappearance of particles by deposition in the reactor. A description is given of a simple pressurized sampling arrangement for obtaining samples of particles from reactors in a form suitable for electron microscopy. The use of the Nolan-Pollak counter is further considered as a means of conducting "in place" tests of high efficiency filter installations and it is concluded that the counter will be of considerable value in this application. (auth)

**45056** HEAT-TRANSFER MEASUREMENTS ON COMPRESSED POWDERS FOR REACTOR PRESSURE-TUBE INSULATION. Lys, L. A. (Swiss Federal Inst. for Reactor Research, Wuerenlingen). Neue Tech., 8: 111-18(June 1966).

The apparatus which has been developed to determine the thermal conductivity of a powder layer as a function of compressive stress is described. A series of measurements was performed with $ZrO_2$, $Al_2O_3$, and $MgO_2$ powders. In order to determine the effect of the granular size, three different fractions were considered for each powder. The samples were submitted to compression from 0 to 90 atm, increased in steps of 30 atm. The insulating properties of the layer deteriorated considerably both with compression and granular size. $ZrO_2$ proved to be a better insulating material for pressure-tube use than either of the other two ceramics considered. (auth)

**45057** ATTRACTIONS AND DISADVANTAGES OF HEAVY WATER NUCLEAR REACTORS. Meriel, Yves. Sci. Progr.-Nature, No. 3374, 201-7(June 1966). (In French).

A brief review is given of the advantages and disadvantages of $D_2O$ nuclear reactors. The major problems in the construction of $D_2O$ reactors are the different degrees of burnup, the moderating properties of $D_2O$, the assembly of structural materials, contamination of the $D_2O$ and heat conducting fluids. (J.S.R.)

**45058** MATRIX CALCULATIONS IN NUCLEAR REACTOR PHYSICS. Rosescu, Th. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz., 18: 585-629 (1966). (In Rumanian).

The various applications to which the matrix theory has been employed in the last few years to derive important new properties and to establish correlations between the reactor theory (transport theory) and other mathematical concepts are examined in detail. (H.D.R.)

## Auxiliaries and Components

*Refer also to abstract 43716.*

**45059** LEAKAGE DISCOVERY IN SODIUM–WATER STEAM GENERATOR. Subbotin, V. I.; Kozlov, F. A.; Ivanovskii, N. N.; Makarov, V. M. At. Energ. (USSR), 20: 482-5(June 1966). (In Russian).

The detection of small leaks in steam generators of the Na-water type was investigated. It was found that the most sensitive method was based on the diffusion of hydrogen from Na in vacuum. A device was constructed and its basic characteristics were determined as a function of the temperature, concentration of the $H_2$ in the Na, and the Na flow. (tr-auth)

**45060** STANDARD GRAPHITE BLOCK. Ivkovic, Magdalena; Zdravkovic, Zoran; Sotic, Obrad. Bull. Boris Kidric Inst. Nucl. Sci., 17: 99-114(Apr. 1966).

A graphite block was calibrated for the thermal neutron flux of the Ra–Be source using In foils as detectors. Experimental values of the thermal neutron flux along the central vertical axis of the system were corrected for the self-shielding effect and depression of flux in the detector. The experimental values obtained were compared with the values calculated on the basis of solving the conservation neutron equation by the continuous slowing-down theory. In this theoretical calculation of the flux the Ra–Be source was divided into three resonance energy regions. The measurement of the thermal neutron diffusion length in the standard graphite block is described. The measurements were performed in the thermal neutron region of the system. The experimental results were interpreted by the diffusion theory for point thermal neutron source in the finite system. The thermal neutron diffusion length in graphite was calculated to be L = 50.9 ± 3.1 cm for the following graphite characteristics: density–1.7 g/cm$^3$; B content—0.1 ppm; absorption cross section—3.7 mb. (auth)

**45061** SOLUTION OF NONLINEAR VIBRATION PROBLEMS IN REACTOR COMPONENTS. Nahavandi, Amir N.; Bohm, George J. Nucl. Sci. Eng., 26: 80-9 (Sept. 1966).

The dynamic response of reactor structural components is obtained by direct numerical solution of the differential equations for a linear or a nonlinear situation considering the components to be a continuous network. The equation of motion of each element is expressed in spatial finite-difference form and integrated to determine deflections as a function of time. The deflection curves and excitation frequencies in a vertical beam, sinusoidally excited at the top and striking an elastic spring at the bottom, are determined satisfactorily as an example of the method. The pattern in this nonlinear system is shown to be similar to the modal behavior of linear structures. The single-valuedness and the lack of discontinuous jumps in the response curve characterize the dynamic stability of the system. The time variation of the beam-end displacements demonstrate the existence of nonuniform distributions of sub- and super-harmonics in the response frequency spectrum. A numerical stability analysis is performed for the problem under study and a criterion for the convergence of the numerical solution is developed. This criterion proved to be satisfactory for the analysis. (auth)

**45062** INSPECTION WINDOW WITH GROOVED METALLIC SEAL: PROBLEM IN THE NUCLEAR REACTOR SECTOR. Bula, K.; Jenni, H. P. Sulzer Tech. Rev. (Switz.), 48: 57-9(1966).

Pressure vessels of enclosed drive units must be equipped with inspection windows. Pressure and temperature conditions would permit a simple O-ring seal, but tests showed that the high leak tightness required cannot be attained in this way, especially with helium as the pressure medium. Leak tightness requirements can be met by using a grooved seal of Anticorodal A. Design principles and the results obtained are presented. (auth)

## Criticality Studies

*Refer also to abstracts 43618, 44577, 44582, and 45126.*

**45063** (AEEW-R-480) METHUSELAH II. A FORTRAN PROGRAM AND NUCLEAR DATA LIBRARY FOR THE PHYSICS ASSESSMENT OF LIQUID-MODERATED REACTORS. Brinkworth, M. J.; Griffiths, J. A. (Atomic Energy Establishment, Winfrith (England)). Mar. 1966. 48p. Dep. BIS $1.40. HMSO 7s. 0d.

METHUSELAH II is a FORTRAN program with a nuclear data library, used to calculate cell reactivity and burnup in liquid-moderated reactors. It has been developed from METHUSELAH I by revising the nuclear data library, and by introducing into the program improvements relating to nuclear data, improvements in efficiency and accuracy, and additional facilities which include a neutron balance edit, specialized outputs, fuel cycling, and fuel costing. These developments are described and information is given on the coding and usage of versions of METHUSELAH II for the IBM 7030 (STRETCH), IBM 7090, and KDF9 computers. (auth)

**45064** (CONF-660303, pp 134-45) THE CHEMICAL BINDING EFFECTS ON THE RESONANCE LINE SHAPES OF $^{238}$U IN A UO$_2$ LATTICE. Adkins, C. R.; Persiani, P. J.; Hwang, R. N.; Kaganove, J. J. (Argonne National Lab., Ill.).

The asymmetry and shift of the Breit-Wigner line shape for $^{238}$U in a UO$_2$ lattice have been studied for selected energy levels at temperatures of 50, 300, and 1500°K. The line shape of the cross sections (including scattering) were developed in a manner similar to that used by Lamb (Phys. Rev., 55: (1939)) for absorption. The phonon frequency spectra were based on the Born-Von Karman description of a crystal and were made consistent with specific heat data. The experimentally determined phonon distribution of Dolling, et al., (Can. J. Phys., 43: 8, 1397(1965)) was also included in the study. In general, pronounced crystalline effect on the line shifts and asymmetries with respect to the gas model (including the classical recoil energy) and the "weak binding" approximation prevailed at the higher temperatures for the low lying levels. Slight line shifts were also noted for the higher energy resonances at the lower temperatures. The changes in the capture resonance integrals (NR and NRIA approximations) due to Doppler broadening were found to differ appreciably between the various models at the lower temperatures and lower energy levels. The crystalline effects on the interference and resonance scattering were included in resonance integral computations. (auth)

**45065** (CONF-660303, pp 146-50) SENSITIVITY OF THERMAL REACTOR PARAMETERS TO SCATTERING MODEL. Worden, J. R.; Purcell, W. L.; Liikala, R. C. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.).

Comparative studies have been carried out to determine the effect of the choice of scattering model for the common moderating materials, H$_2$O, D$_2$O, and graphite, on calculated reactor parameters. Calculations of the thermal reproduction factor, $\overline{\eta}$, and the thermal utilization, f, have been made for uranium and/or plutonium for which measured values of parameters are available. The calculations were performed using the thermalization code, THERMOS, in conjunction with kernels generated using various scattering models. It is concluded that scattering in graphite is adequately represented by the Parks' kernel if the criterion for adequacy is matching the core parameters, $\overline{\eta}$ and f. This has been confirmed for systems containing uranium only and both uranium and plutonium where, in each case, calculated values of the parameters agree with those measured within the experimental uncertainty. The inadequacy of the free gas model for graphite is exhibited by discrepancies of 1 to 2% in the calculated value of f. It is shown that neglecting anisotropic scattering in H$_2$O leads to large errors in calculated parameters. Results of the study of scattering in D$_2$O are not conclusive and indicate the need for further study of simpler systems. (auth)

**45066** (CONF-660303, pp 151-70) THE SENSITIVITY OF D$_2$O MODERATED REACTOR PARAMETERS TO THERMAL NEUTRON SCATTERING LAW. Suich, John E. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.).

The sensitivity of D$_2$O-moderated reactor parameters to the scattering law model employed in calculations on thermal neutron spectra is investigated. The three models studied were the D$_2$O-bound deuterium model, the Brown-St. John model, and the Honeck-Nelkin model. Comparison with experimental data indicates that these models produce errors of a few tenths of 1% in reactivity, 1–2% in conversion ratios, and 10–15% in temperature coefficients. (S.F.L.)

**45067** (CONF-660303, pp 259-69) PERTURBATION THEORY IN BURNUP CALCULATIONS. Vaughan, E. U. (Atomics International, Canoga Park, Calif.).

A perturbation theory for reactor burnup calculations has been developed, and applied to perturbations of the limiting lifetime, beyond which the reactor cannot achieve criticality. Because of the non-linearity of the burnup equations, the flux and composition variables do not have adjoints, but sufficiently small variations of these variables satisfy linear equations, and consequently do have adjoints. A FORTRAN IV program has been written to calculate burnup histories for a simple two-group point-burnup model, and to utilize such histories to set up and solve the associated adjoint equations. Some calculations with this program are reported. (auth)

**45068** (CONF-660303, pp 430-53) CROSS SECTION UNCERTAINTIES AND REACTOR SAFETY. Okrent, David (Argonne National Lab., Ill.).

Cross section uncertainties lead to uncertainties in reactivity coefficients and consequent uncertainties in nuclear reactor behavior during dynamic situations. Where potentially serious accidents are under consideration, cross section uncertainties thus have a direct bearing on reactor safety. In this paper, illustrations are given of the major role played by the Doppler coefficient in limiting the consequences of severe reactivity excursions, both in sodium-cooled fast reactors and in water-cooled and -moderated thermal reactors. Also discussed in the delicate balance between opposing phenomena which yield major reactivity contributions to the sodium void reactivity coefficient in large fast reactors, and the inter-relation between Doppler effect and positive sodium void effect in accident studies which involve large reactivity insertion rates due to boiling and expulsion of sodium in the presence of a net positive void effect on reactivity. The manner in which uncertainties in $^{233}$U fission and capture can lead to a question in sign of the moderator coefficient for gas-cooled reactors is illustrated, and the importance of high-energy scattering cross sections to possible embrittlement of reactor pressure vessels is treated. (auth)

**45069** (CONF-660303, pp 809-20) SENSITIVITY OF FAST REACTOR PARAMETERS TO CROSS SECTION UNCERTAINTIES. Hummel, Harry H. (Argonne National Lab., Ill.).

One of the most serious uncertainties facing fast reactor designers is the coolant void effect, which has potentially important safety implications. A series of recent comparison calculations showed discrepancies in the results from various organizations that would be equivalent to 2% k for complete voiding of sodium from a reactor core. These discrepancies arose primarily from differences in the energy variation of the neutron importance function because of differences in assumed fission and capture cross sections. An investigation into the causes of these discrepancies showed that the most important factor was a difference in assumed $^{239}$Pu fission and capture cross sections and $^{238}$U capture cross sections, particularly at energies below 100 kev. These differences ranged up to a factor of two in the former case and to 50% in the latter. In the former case this may really represent the range of uncertainty. In the latter, however, use of the latest resonance parameters for $^{238}$U would have reduced discrepancies. Variations in assumed $^{240}$Pu and fission-product capture cross sections give significant but generally smaller effects. There was a large disagreement in calculated critical masses for very dilute reactors which at present appears also to be due to differences in assumed $^{239}$Pu fission and $^{238}$U capture, particularly at low energies. (auth)

**45070** (CONF-660303, pp 823-39) FISSION RESONANCE CROSS SECTION REQUIREMENTS FOR REACTOR DESIGN. Harris, D. R. (Bettis Atomic Power Lab., Pittsburgh, Pa.).

Cross section requirements for reactor design are reviewed for the fissile nuclides in the resonance energy range. The types of cross sections required, their required accuracies, and storage forms are examined. Use of the Reich and Moore multilevel-multichannel analysis for storage of resonant cross sections is recommended. (auth)

**45071** (CONF-660303, pp 1092-7) LOW FLUX DETERMINATION OF CAPTURE-TO-FISSION RATIO. Redman, W. C.; Bretscher, M. M. (Argonne National Lab., Ill.).

A novel method which makes possible a direct measurement in low-power reactors of the effective capture-to-fission ratio, $\overline{\alpha}$, has been developed. It involves a comparison of reactor response to oscillated samples of a fissile material, an absorber, and a spontaneous fission source, augmented by an experimental determination of the respective fission rate, capture rate, and neutron-source strength. These experimental results, combined with the number of neutrons per fission of the fissile material, yield a value for the quantity $1 + \overline{\alpha}$. Applications for this technique are illustrated by the results for measurements with $^{235}$U in both an undermoderated critical assembly of moderately enriched $^{235}$U in light water and an epithermal, 1/E neutron spectrum. (auth)

**45072** (GEMP-424) PROGRAM AVOID, NMP-838: A FORTRAN IV PROGRAM FOR EVALUATING THE EQUIVALENT DIFFUSION COEFFICIENT AND LOSS CROSS SECTION OF AN ANNULAR VOID IN CYLINDRICAL REACTORS. Henderson, W. B. (General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation). Apr. 15, 1966. Contract AT(40-1)-2847. 30p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Given the inner and outer radii of a void annulus, the neutron flux ratio across the annulus, and the effective escape probabilities for neutrons entering the void, program AVOID computes the effective diffusion coefficient, D, and loss cross section $\Sigma_L$, which are consistent with a $P_1$ flux expansion in the void. (auth)

**45073** (INR-659/IXA/RP) HELENA CODES FOR MATERIAL BUCKLING DETERMINATION IN SUBCRITICAL ASSEMBLIES. Dabrowski, Cyryl; Mikulski, Andrzej T. (Institute of Nuclear Research, Warsaw (Poland)). Oct. 1965. 100p. Dep.

Codes for computation of material buckling from thermal neutron flux distributions in an unreflected subcritical assembly, written in GIER ALGOL III language, are described. Three methods are elaborated: (1) based on vertical axis measurement of neutron flux and an assumption of thermal neutron point source, (2) based on horizontal plane and vertical axis measurement of neutron flux, and (3) based on two horizontal planes measurement of neutron flux. Additionally a code for the determination of the extrapolation length is given. (auth)

**45074** (JAERI-1107) KINAK: A CODE FOR ONE-DIMENSIONAL, NUCLEAR, THERMAL AND HYDRAULIC CALCULATION FOR BOILING WATER REACTOR. Mochizuki, K.; Ito, T.; Kuge, Y.; Ishikawa, M.; Naito, Y.; Kobori, T. (Japan Atomic Energy Research Inst., Tokyo). Oct. 1965. 33p. (In Japanese).

The KINAK Code for calculating the one-dimensional, nuclear, thermal, and hydraulic performance of a boiling water reactor is described. The outputs calculated by this code are the axial neutron flux distribution, power distribution, heat flux distribution, burn-out ratio, temperature profile of a fuel rod, pressure drop through the reactor core, fitting coefficients of the nuclear constant versus void, effects of Xe and Sm, and Doppler effect. Each subroutine is explained, and examples of the calculation are quoted. The program is written in FORTRAN IV for the IBM 7044. (auth)

**45075** (JAERI-1109) GROUP CONSTANTS FOR A FAST REACTOR AND SODIUM VOID EFFECTS. Katsuragi, Satoru; Ishiguro, Yukio; Kato, Osamu (Japan Atomic Energy Research Inst., Tokyo). Dec. 1965. 27p. (In Japanese). Dep. mn.

The basic principle leading to the group equation and the effective group constants is discussed, which are applicable to the prediction of almost all the quantities. The perturbation operator to be used for calculation of the reactivity effect should be calculated from the difference between the group operators of the perturbed and unperturbed systems. The actual method for obtaining the effective group cross sections is described, and then the code ESELEM is explained as an example of application of the method. The special stress is placed on the calculation of the Na void effect. The effect for the zone loaded system is described and discussed. (auth)

**45076** (K-DP-1637) ADJOINT MONTE CARLO CALCULATIONS FOR ENRICHED URANIUM METAL ASSEMBLIES. Morrison, G. W.; Whitesides, G. E.; Irving, D. C. (Oak Ridge Gaseous Diffusion Plant, Tenn.). [1966]. Contract W-7405-eng-26. 5p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The feasibility is demonstrated for obtaining multigroup adjoint Monte Carlo predictions of the multiplication constants for complicated geometries. (M.O.W.)

**45077** (MIT-2344-5) A STUDY OF THE SPATIAL DISTRIBUTIONS OF FAST NEUTRONS IN LATTICES OF SLIGHTLY ENRICHED URANIUM RODS MODERATED BY HEAVY WATER. Woodruff, Gene L.; Kaplan, I.; Thompson, T. J. (Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering). Nov. 1965. Contract AT(30-1)-2344. 216p. (MITNE-67). Dep. mn. CFSTI $6.00 cy, $1.25 mn.

Intracellular distributions of the activation of threshold foil detectors were measured in seven $D_2O$-moderated lattices of U metal rods: with varying rod diameters and spacings. The reactions used in the measurements included $^{115}$In(n,n')$^{115m}$In, $^{238}$U(n,f), $^{58}$Ni(n,p)$^{58}$Co, and $^{64}$Zn(n,p)$^{64}$Cu. The distributions were found to be the same for the different reactions with the possible exception of the Zn reaction in the more widely spaced lattices, and were found to be strongly dependent on rod diameter and rod spacing, but independent of $^{235}$U concentration, at least for the small differences in concentrations existing in the lattices studied. Methods were developed for correcting the experimental data for the activity resulting from competing capture reactions which accompany the threshold reactions. A kernel method was developed, the UNCOL code, for computing the spatial distribution of the uncollided fast flux in assemblies with cylindrical fuel elements. Good agreement was obtained between experimental results and the results of UNCOL calculations using values of 0.093 $cm^{-1}$ and 0.100 $cm^{-1}$ for the removal cross sections for $D_2O$ and U respectively. These values, which can be considered experimental values of the removal cross sections, are close to the calculated values found in the literature for one energy group above 1.35 Mev, 0.0899 $cm^{-1}$ for $D_2O$ and 0.1039 $cm^{-1}$ for U. The results of UNCOL calculations also gave good agreement with distributions of the $^{58}$Ni(n,p)$^{58}$Co reaction measured in the experimental facilities in and around the MITR core. A relationship between $\delta_{28}$ and the UNCOL results was derived. This relationship was applied to previous measurements of $\delta_{28}$ and was found to correlate the experimental results very well for values of $\delta_{28}$ less than about 0.055. The systematic discrepancies for higher values was attributed to spectral shifts occurring in the more tightly spaced lattices of 0.75-in. and larger rods. The HEETR code was used to calculate the intracellular distributions of the threshold reactions used in the experiments as well as values of $\delta_{28}$ for the lattices in which experimental results had been obtained. The calculated intracellular distributions agreed well with both the experimental results and those of UNCOL calculations. The calculated values of $\delta_{28}$ were consistently lower than corresponding experimental values. (auth)

**45078** (MIT-2344-6) USE OF NEUTRON ABSORBERS FOR THE EXPERIMENTAL DETERMINATION OF LATTICE PARAMETERS IN SUBCRITICAL ASSEMBLIES. Harrington, J.; Lanning, D. D.; Kaplan, I.; Thompson, T. J. (Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering). Feb. 1966. Contract AT(30-1)-2344. 202p. (MITNE-69). Dep. mn. CFSTI $6.00 cy, $1.25 mn.

A new method for measuring values of the multiplication factor for an infinite medium, $k_\infty$, was developed. The method involves addition of neutron absorbers to subcritical assemblies. Measurements of the values of $k_\infty$, for three lattices of U metal rods in heavy water were made. Solid copper rods were used as absorbers. The values of $k_\infty$ were found to be in agreement, within experimental uncertainties, with values obtained with the four-factor formula. The method used is closely related to the Hanford (PCTR) technique for measuring $k_\infty$, which requires a critical reactor. Since it is nearly a measurement of $(k_\infty - 1)$, and because the measured values are independent of a number of sources of error in the four-factor formula, the uncertainties in the measured values should be smaller than those obtained with the four-factor formula. The work shows that a 3% uncertainty in $(k_\infty - 1)$ may be obtained with the method, comparable with the uncertainty in PCTR measurements. Measured values of the neutron regeneration factor were also determined. They agree well with values computed with the THERMOS code. The results of exploratory experiments indicate that it may be possible to do the measurements in two-region subcritical assemblies. (auth)

**45079** APPLICATION OF TOPOLOGICAL METHODS TO THE STUDY OF CRITICAL CONDITIONS OF A REACTOR. Bakhtin, I. A. (Voronezh State Pedagogical Inst., USSR). Dokl. Akad. Nauk SSSR, 167: 16-18(Mar. 1, 1966). (In Russian).

Topological methods are used to study a special system of equations of the form $x = \mu A(x,y)$, $y = B(x,y)$. The obtained results are applied to the study of critical conditions of a reactor, and two theorems on calculating the rotation of vector fields are formulated. The distribution of the neutron flux and temperature over the volume of the reactor is described by equations and this system is replaced by the equivalent system of differential equations. (auth)

**45080** NUCLEAR POISONS. Blum, J. M. Energ. Nucl. (Paris), 8: 285-7(June 1966). (In French).

An annotated bibliography is presented for reactor poisons. Various compound neutron absorbers composed of B, Hf, Cd, and the rare earths are reviewed, and general problems are discussed. The properties of these materials are treated independent of their use. (J.F.P.)

**45081** SPACE AND ENERGY EFFECTS IN REACTOR FLUCTUATION EXPERIMENTS. Natelson, M.; Osborn, R. K.; Shure, F. (Univ. of Michigan, Ann Arbor). J. Nucl. Energy: Pt. A and B, 20: 557-85(July 1966).

An analysis of the space and energy dependence of neutron fluctuations is presented, and applied to the results of reactor fluctuation experiments. Two experiments, measurements of power spectral density and variance-to-mean, are singled out for special attention. These are of special interest, since previously published experimental results seem to be interpretable by space and energy-independent theories of neutron fluctuations. Both infinite and finite-geometry reactor models are treated, and calculations are presented to illustrate the effects of detector size, shape and location, and delayed neutrons. In any event, agreement with actual experimental results is achieved only when the effect of fast diffusion is included through a two-energy group model. It is seen that when the migration length is sufficiently large by comparison with a typical reactor dimension, the results of the space-energy independent theory appear as a first approximation. Thus it is argued that experiments on larger reactors would yield results not in agreement with the space-energy independent theory. (auth)

**45082** MEASUREMENT OF SPACE-DEPENDENT SOURCE TRANSFER FUNCTION USING PULSED NEUTRON SOURCE. Kaneko, Yoshihiko (Japan Atomic Energy Research Inst., Tokyo); Akino, Fujiyoshi; Kurokawa, Ryosuke; Sumita, Kenji. J. Nucl. Sci. Technol. (Tokyo), 3: 301-4(July 1966).

Results of a study are presented in which reactor source transfer functions for two subcritical cores of SHE were determined by numerical Fourier transformation of the detector response against injections of fast pulsed neutrons. (J.R.D.)

**45083** PROOF OF THE FORMULA FOR THE ROSSI-$\alpha$ METHOD. Furuhashi, Akira; Inaba, Gohzoh (Tokyo Inst. of Technology). J. Nucl. Sci. Technol. (Tokyo), 3: 305-6 (July 1966). (In German).

The theory of Rossi-$\alpha$ measurements was developed by

Hoffmann and Orndoff for the energy-independent and space-independent case. Their formula give the probability that two neutrons in the interval $dt_1$ for $t_1$ and the interval $dt_2$ for $t_2$ will be counted in a counting tube. This definition is discussed for the case of a very subcritical reactor. Corrections derived for the formula are given. (M.C.G.)

**45084** SLIGHTLY ENRICHED URANIUM SINGLE-ROD HEAVY-WATER LATTICE STUDIES. Lutz, H. R.; Heer, W.; Meier, R. W. (Federal Inst. for Reactor Research, Wuerenlingen, Switzerland). Neue Tech., 8: 130-42(June 1966).

The results of a series of buckling and microparameter measurements on square lattices of 0.96% enriched U metal rods are given. The experiments were performed in the subcritical facility MINOR. A special chapter deals with approach to criticality experiments. These were necessary in order to determine whether a lattice would reach criticality at finite $D_2O$ levels. The method used gave very reliable extrapolations for the determination of critical $D_2O$-heights. The experimental bucklings are compared with 4 buckling codes and show considerable deviations in the undermoderated region. (auth)

**45085** DETERMINATION OF RADIAL BUCKLING IN REFLECTED SYSTEMS. Serdula, K. Nucl. Sci. Eng., 26: 1-12(Sept. 1966).

Results of an experimental investigation indicate an improvement in accuracy of radial bucklings derived from activation distributions measured in reflected cylindrical systems can be obtained if: resultant activities are fitted to radial spatial functions derived from homogeneous two-group diffusion theory (i.e., Activity (R) = A $J_0(\lambda R)$ + C $I_0(\beta R)$, where $\lambda^2$ = radial buckling, and activation distributions are measured with a detector whose ratio of $\overline{\Sigma}_{fast}/(\overline{\Sigma}_{fast} + \overline{\Sigma}_{thermal})$ is high. Radial bucklings derived from activation distributions measured with In, Au, and Cu foils in the same core showed that values derived from the In data were the least sensitive to the region of the core analyzed. On the basis of a two-group model, radial activation distributions measured with a detector in a reflected core which satisfies the following condition $\overline{\overline{\Sigma}}_{thermal} = S_1 \overline{\Sigma}_{fast}$, where $S_1$ = fast-thermal coupling coefficient, will yield a $J_0$ distribution only, because the increase in activity from the increase in thermal flux is cancelled by the decrease in activity from the decrease in fast flux near the core-reflector boundary. Conclusions are substantiated by theoretical predictions based on the radial variation of fluxes calculated from two-group homogeneous diffusion theory. (auth)

**45086** APPLICATION OF LANGEVIN'S TECHNIQUE TO SPACE- AND ENERGY-DEPENDENT NOISE ANALYSIS. Akcasu, A. Ziya (Brookhaven National Lab., Upton, N. Y.); Osborn, R. K. Contract AT(30-2)-Gen-16. Nucl. Sci. Eng., 26: 13-25(Sept. 1966). (BNL-9533).

The space- and energy-dependent theory of reactor-noise analysis has been developed using Langevin's technique starting from the transport equations. The theory includes delayed neutrons. The correlation function and the power spectral density for the detection rate, as well as for the neutron density, have been obtained. The application of the general theory to simple reactor models has been discussed and illustrated by considering the one-speed transport and one-speed diffusion approximations. The connection between Langevin's technique and the doublet theory based on the Liouville equation has been established. It has been found that both formulations yield identical results and that the postulates of Langevin's technique are justified for the study of neutron distributions. (auth)

**45087** THEORETICAL AND EXPERIMENTAL CRITERIA FOR NONLINEAR REACTOR STABILITY. Gyftopoulos, Elias P. Nucl. Sci. Eng., 26: 26-33(Sept. 1966).

Criteria for nonlinear asymptotic stability of nuclear reactor systems representable by point reactor kinetics are derived. The reactor system model includes all delayed neutron precursors and linear feedback. The results are also extended to systems where the feedback is not linear. A procedure is outlined for the interpretation of the criteria by means of small-amplitude perturbation tests. The procedure is illustrated by using experimental transfer function measurements from Experimental Boiling Water Reactor. (auth)

**45088** DOPPLER COEFFICIENT MEASUREMENTS ON Th AND $ThO_2$ RODS WITH NONUNIFORM TEMPERATURE DISTRIBUTIONS. Pettus, W. G.; Baldwin, M. N. Nucl. Sci. Eng., 26: 34-46(Sept. 1966).

Measurements of the Doppler effect in resonant neutron capture were made for samples having a nonuniform temperature distribution. These measurements were made on Th and $ThO_2$ rods of approximately 3/4-in. diam. An activation technique was used, and the samples were exposed in a cadmium thimble at the center of a pool research reactor. The activated samples were dissolved and the $^{233}Pa$ was separated out and gamma counted. The Doppler coefficients for identical samples were determined with an axial heat source and with a peripheral heat source. In the axially heated cases, measurements were made with radial temperature drops ranging up to 185°C for the metal samples, and up to 1000°C for the oxide samples. In the peripherally heated cases, the temperature was uniform through the samples, and measurements were made with the temperature ranging up to about 350°C for both metal and oxide samples. The results show that the Doppler coefficient as a function of the average sample temperature is essentially the same for both axial and peripheral heating over the temperature range investigated. The measured values of the Doppler coefficients for the nonuniform temperature cases were $(85 \pm 5) \times 10^{-4}$ and $(95 \pm 19) \times 10^{-4}$ $(°K)^{-1/2}$ for Th metal and oxide, respectively. (auth)

**45089** THE NEUTRON SPECTRUM IN A $UO_2$ TUBE AT DIFFERENT TEMPERATURES. Johansson, E.; Jonsson, E.; Lindberg, M.; Mednis, J. Nucl. Sci. Eng., 26: 47-58(Sept. 1966).

Experiments and calculations on the neutron spectrum in a $UO_2$ tube at various temperatures were performed. The tube, 65.6-mm o.d., 32.3-mm i.d., and 300-mm high, was canned in steel and mounted in a container which was placed in the central vertical channel of the reactor R1. The tube was heated by the fission energy which was enough to keep it at a maximum temperature of 750°C. The lowest temperature was 50°C. With the fast chopper, the spectrum from a lead scatterer in the center of the tube was measured. This spectrum was multiplied with some correction factors to obtain the spectrum in the scatterer, which is the final result from the measurements. The increase of the temperature from 50 to 750°C gave an appreciable hardening of the neutron spectrum. This hardening will increase the reaction rate in $^{239}Pu$ by 7.5% if one normalizes to equal reaction rate in a 1/v absorber. Only a minor part of the value 7.5% depends on the heating of the steel and the lead. In the calculations the THERMOS code with the effective-width model for deuterium was used. All other materials, including $UO_2$, were treated with the free-gas model. The energy ranged from 0.00025 to 3.06 ev. The experimental and computed spectra agreed reasonably well in the thermal region both at 50 and at 750°C. The calculated epithermal ratio and, to some extent, the spectrum in the joining region were sensitive to the value of the cell radius used in the calculations. The ratio between the high-temperature spectrum and the low-temperature spectrum appeared to be rather insensitive to the value of the cell radius even for epithermal energies, and a remarkable agreement with the measured ratio was found. Some THERMOS calculations were also made on the influence of hot steel and hot lead and on the influence of elevated moderator-temperature—220°C instead of the value 33°C used in the experiments. (auth)

**45090** DIFFERENTIAL AND INTEGRAL THERMAL-NEUTRON SPECTRA OF $D_2O$-MODERATED LATTICES. Salah, Sagid; Parkinson, T. F. Nucl. Sci. Eng., 26: 59-66(Sept. 1966).

The thermal-neutron spectrum throughout the unit cell of several $D_2O$-moderated natural-U lattices were measured using both differential and integral methods. For the differential measurements the neutron diffraction method was used, and for the integral measurements, space-dependent spectra were deduced from activation of Au and Lu detectors. To obviate the numerous corrections normally required for the diffraction method, the total efficiency of the crystal spectrometer was determined using a beam with a known spectrum from a $D_2O$ thermal column. Satisfactory agreement was found between the activation measurements and theoretical results obtained with the THERMOS Code. However, effective neutron temperature changes derived from the differential spectra were systematically lower than the THERMOS calculations. Some uncertainty remains as to the precision of the differential spectra due to the method of calibration and the perturbing effect of the beam tube. Nevertheless, most of the measured spectra are in reasonably good agreement with calculated spectra. (auth)

**45091** BIAS IN NUCLEAR REACTOR POWER SPECTRAL DENSITY ESTIMATES WITH FINITE RECORD LENGTHS. McGrath, E. J.; Albrecht, R. W. (Univ. of Washington, Seattle). 21p. (CONF-660206-16). ORAU. Gmelin, AED-CONF-66-014-18.

From Symposium on Neutron Noise, Waves and Pulse Propagation, Gainesville, Fla.

The effect of the record length on estimates for the power spectral density of neutron multiplying systems (with delayed neutrons) is investigated, and explicit formulations from which corrections can be obtained if required are offered. (J.F.P.)

**45092** USER REQUIREMENTS FOR CROSS SECTIONS IN THE ENERGY RANGE FROM 100 ev TO 100 kev. Greebler, P.; Hutchins, B. A. (General Electric Co., San Jose, Calif.). 32p. (CONF-660303-36). ORAU. Gmelin, AED-CONF-66-034-22.

From American Physical Society, Conference of Neutron Cross Section Technology, Washington, D. C.

A comprehensive evaluation is made of the sensitivity of important physics parameters of large fast power reactors to uncertainties in the cross-section data between 100 ev and 100 kev. Reactors using U−Pu and U−Th fuel cycles, oxide and carbide fuels, Na and steam coolants, and a broad variation in neutron leakage and spectrum were considered. Satisfactory accuracy in the computations of fissile mass (±1%), breeding ratio (±1%), Doppler coefficient (±5%), and Na void reactivity (±0.5$) requires accuracies of ±3% for $\sigma_{(n,f)}$ of $^{239}$Pu (or $^{233}$U) and $\sigma_{(n,\gamma)}$ of $^{238}$U (or $^{232}$Th); ±5% for $\sigma_{(n,\gamma)}$ of $^{239}$Pu and $^{240}$Pu and $\sigma_{(n,f)}$ of $^{241}$Pu; ±10% for $\sigma_{(n,\gamma)}$ of combined fission products, and important clad materials. (auth)

**45093** OPTIMAL SHUTDOWN CONTROL OF NUCLEAR REACTORS. Ash, Milton. A Series of Monographs and Textbooks. Mathematics in Science and Engineering. Volume 26. New York, Academic Press, 1966. 180p. $8.50.

The problem of optimal shutdown and subsequent startup of nuclear reactors with respect to their concomitant isotopic poisons, mainly $^{135}$Xe is discussed. The recently developed mathematical discipline termed dynamic programming is used. The problem is approached from the viewpoint of the modern variational calculus. Similarities between this approach and that obtained by using the Pontryagin maximum principle are discussed. Experimental results from an operating reactor are compared with the computed theoretical shutdown programs. (B.G.D.)

# Fuels

*Refer also to abstracts 43489, 43814, 43853, 43855, 43865, 43874, 43900, 43929, and 45106.*

**45094** (BAW-3460-2) RECYCLE URANIUM FABRICATION PROGRAM. Final Report. (Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.). Aug. 1966. Contract AT(30-1)-3460. 69p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Recycled $^{233}$U is usually contaminated with a small amount of $^{232}$U which, through some of its decay daughters, contributes significantly to the gamma radioactivity of recycled $^{233}$U fuels. The resultant fabrication problem is usually solved by using remote or semi-remote techniques. To avoid the inherently high capital and operating costs of such methods and to simplify maintenance problems, a method was developed whereby the $^{233}$U fuel can be deactivated and then refabricated directly. The fuel is deactivated by removing the first daughter of $^{232}$U ($^{228}$Th) and is then refabricated rapidly before the increase in the $^{232}$U daughters and the associated gamma activity creates a hazard. Customary glove box techniques are used in refabrication. The pilot plant is based on this principle. A glove-box line is used for fuel material preparation. The sol-gel method is used to convert $UO_2(NO_3)_2$ and $Th(NO_3)_4 \cdot 4H_2O$ feed into a high-density $ThO_2-UO_2$ powder. A glove-box line for fuel rod fabrication by vibratory compaction of the powder is employed in the second step. A pool, in which the fuel rods are stored, shields the gamma activity which keeps growing while the required number of rods are being fabricated. An underwater assembly machine then mechanically inserts the rods into a fuel assembly. The pilot plant was successfully tested with about 390 kg of natural material before being operated with 82 kg of oxide containing approximately 2.3 kg of $^{233}$U contaminated with about 42 ppm $^{232}$U. A prototype element typical of those used in pressurized water reactors was fabricated. Radiation exposures to the operators were well within permissible limits. The information gained during the hot runs indicates that 1000 ppm $^{232}$U/$^{233}$U is representative of the level of impurity that can be tolerated in the existing pilot plant operating for five days at a capacity of 50 kg of $ThO_2-3$ wt % $UO_2$ per week. A detailed design study of a production-sized $^{233}$U cleanup system was carried out. This system is patterned after the third cycle of the Thorex process and serves two purposes: deactivation of $^{233}$U feed solution from the reprocessing plant and recovery of $^{233}$U scrap from the fabrication plant. The capacity of the facility ranges from 2 to 20 kg of $^{233}$U per day, depending on the feed, and is quite versatile in operation. The experimental program and major results are summarized and evidence of the feasibility of the direct fabrication technique is furnished. (auth)

**45095** (BNWL-273(Vol.3)) COMPARATIVE COSTS OF OXIDE FUEL ELEMENTS. VOLUME 3. THE EFFECT ON FUEL ELEMENT COSTS WHEN CERTAIN REFERENCE VALUES ARE VARIED. Burnham, J. B.; Merker, L. G.; Deonigi, D. E. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug. 1966. Contract AT(45-1)-1830. 19p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

The costs of fabricating a reference oxide fuel element by the vibrational compaction and sintered pellet processes incorporating three modes of enrichment ($UO_2$, low exposure $PuO_2$, and high exposure $PuO_2$) are examined. The effects of varying throughput, high exposure Pu shielding, Zircaloy cost, U and Pu costs, use charge rate, and working capital rate on fuel element costs are investigated. (H.D.R.)

**45096** (BNWL-289) POSSIBLE OPTIMUM USE OF THORIUM AND URANIUM EMPLOYING CROSSED-PROGENY FUEL CYCLES. Eschbach, E. A.; Deonigi, D. E. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). May 1966. Contract AT(45-1)-1830. 26p. (CONF-660524-14). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From 2nd International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn.

A study was made of the various ways of combining the advantages of Th and U fuel cycles so that Th could be more economically used in thermal reactors. The following conclusions are made: The crossed-progeny fuel cycles can be competitive with slightly enriched U fuel cycles; crossed-progeny fuel cycles would upgrade present LWR performance, making it a true advanced converter; heavy water reactors fueled with Pu–Th could economically supply the $^{233}$U for the cycles; Pu–Th fuel would not contaminate the new $^{233}$U with $^{235}$U and $^{236}$U; the high enrichment required by Th fuels could be decreased by reducing the Th density; and very high specific power and reductions in reactivity swing could be obtained by using Th, $^{238}$U, and Pu as a ternary fuel. (D.L.C.)

**45097** (WCAP–2972) IRRADIATION OF REFRACTORY FUEL COMPOUNDS, $UO_2$ AND UC, AT HIGH SPECIFIC POWER TO HIGH BURNUPS: POST-IRRADIATION EXAMINATION OF CAPSULE 1. First Interim Report. Schreiber, Richard E. (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). Aug. 1, 1966. Contract NAS-3-3392-PB. 81p. (NASA-CR–72019).

The first of thirteen capsules, each containing four fuel pins, was irradiated and examined. Three of the pins are $UO_2$ and the fourth is UC. Mean power levels of 33 kw/ft and burnups of $2.26 \times 10^{20}$ fission/cc were achieved in each of the 0.3000-inch-diameter, 4.0-inch-long fuel pellet columns. The AISI 348 stainless steel clad was 10, 20, or 30 mils thick on the $UO_2$ pins and 20 mils on the UC. All pins were gas-bonded, surrounded by NaK, and operated at approximately 760°C fuel surface temperature. Fission gas release, density changes, melting behavior, and dimensional changes agreed well with predictions. The 20-mil-clad $UO_2$ pin failed, evidently by local NaK deprivation. (auth)

**45098** (WCAP–3374-4) SUPERCRITICAL TECHNOLOGY PROGRAM. Third Quarterly Progress Report, October–December 1964. Patterson, J. F.; Boyd, W. S. (comps. and eds.) (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). Contract AT(30-1)-3374. 95p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Activities in a program to build and install a supercritical water-cooled, in-pile fuel testing loop, and test fuel in a pressure tube to demonstrate the feasibility of collapsed clad elements in a reactor environment, cooled by supercritical water, are reported. Work toward evaluation of the design of the fuel elements by post-irradiation examination and evaluation of loop performance by analyzing operating data are also reported. Two fuel assemblies manufactured by different methods (pellets and vibratory compaction) will be tested. Two clad materials (16 Cr–20 Ni SS and Incoloy 800) will be included in each assembly. An existing loop design and a large number of loop components previously purchased by Westinghouse were turned over to the AEC under the terms of the contract. The design of the loop is complete and the remainder of the components are being purchased under the contract. Fuel assembly and pressure tube designs were completed. The pressure tube and fuel assemblies are being fabricated. (auth)

**45099** LES COMBUSTIBLES NUCLEAIRES. (Nuclear Fuels). Sauteron, Jean. Paris, Hermann, 1965. 530p. 180 F.

A brief review is given of the physical concepts necessary for discussion of nuclear energy. The present and future applications of nuclear energy are summarized. The principal constituents of reactors are examined and the large families of reactors are reviewed together with the different types of fuel elements used. The transformations of U from its mining, ore processing, refining of the concentrates, isotopic enrichment, and fabrication of fuel elements up to its use in the reactor are described. The modifications in composition and structure of the fuel induced by reactor radiation are discussed, and reprocessing the irradiated fuel is considered. The characteristics of Pu and Th as fuels are also discussed. The different fuel cycles and their effects on the cost of nuclear energy are examined. (J.S.R.)

**45100** FUEL DEVELOPMENT FOR A HIGH-TEMPERATURE FAST REACTOR. Beifzwenger, H.; Huschka, H.; Liebmann, B.; Mueller, N.; Neumann, O. (Kernforschungszentrum, Karlsruhe, Ger.). 13p. (CONF-178–7). ORAU.

From European Atomic Energy Society's Symposium on Fuel Cycles for Power Reactors, Baden-Baden, Ger., Sept. 1963.

Methods for the fabrication of $UO_2$ fuel rods for high heat rating and burnups in the range of 100,000 Mwd/t are being developed. The techniques used are simple enough to facilitate remote fabrication of (U, Pu)$O_2$ fuel in a later stage of the program. Special powders for vibrational compaction and swaging have been prepared by granulating and sintering. The thermal conductivity of $UO_2$ has been improved by Mo additions. At 1000°C the thermal conductivity both of pellets and powder packed fuel containing 85% $UO_2$ and 15% Mo is two to three times better than that of pure $UO_2$. Whether a factor of two or three is reached, depends on the distribution of the metal. (auth)

## Power and Power-Breeder Reactors

*Refer also to abstracts 43422, 43800, and 43875.*

**45101** (66-CNA-305) A STATUS REPORT: KARACHI NUCLEAR POWER PROJECT. Johnston, R. C. (Canadian Nuclear Association, Toronto (Ontario)). [1966]. 10p. (CONF-660516–12). Dep. mn.

From Annual Conference on Organic and Heavy Water Reactors, Winnipeg, Canada.

A brief summary is presented of background information on the Karachi 125-Mw(e) (net) nuclear power plant. The temperature of the Arabian Sea and general site conditions are discussed. The construction schedule is given and discussed. (D.L.C.)

**45102** (66-CNA-320) CANADA AND NUCLEAR POWER, 1966. Lessard, Jean-Claude (Canadian Nuclear Association, Toronto (Ontario)). 14p. (CONF-660516–7). Dep. mn.

From Annual Conference on Organic and Heavy Water Reactors, Winnipeg, Canada.

A general discussion is presented of the Canadian nuclear industry. Prospects for nuclear power over the world are discussed, and the possibility of using nuclear power to solve food and water problems is suggested. Developments in nuclear power plants in Canada and overseas are described, and heavy water supply problems are considered. Activities in radioisotope production and techniques are next discussed. Other aspects of the nuclear industry which are discussed include: demand for uranium, nuclear exports, and control of nuclear proliferation. (D.L.C.)

**45103** (AECL–2590) COMPARISON OF $^{240}$Pu AND $^{238}$U IN THERMAL FISSION REACTORS AND ITS RELATION TO THE LONG TERM IRRADIATION OF NATURAL URANIUM. Lewis, W. B. (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Sept. 1951. Reprinted July 1966. 21p. (DR–19). Dep. mn. AECL $0.50.

The high capture cross-section of $^{240}$Pu (≈ 600 barns) is responsible for a considerable fraction of the reactor poisoning, which results from the long irradiation (> 1500 MWD/ton) of natural U in a thermal fission reactor. The $^{240}$Pu isotope has therefore been regarded as undesirable; it appears, however, on further consideration that $^{240}$Pu may well be more useful than $^{238}$U in such reactors. It follows that the most economical course of action to maintain the reactor in operation is likely to be to reduce the amount of $^{238}$U in the reactor rather than to remove the long irradiated metal containing $^{240}$Pu. (auth)

**45104** (AEET–239) PHYSICS STUDIES OF PROTOTYPE POWER REACTOR PROJECT. Rastogi, B. P.; Srinivasan, K. R.; Nakra, A. N.; Bhatia, H. K.; Huria, H. C.; Balakrishnan, K.; Purandare, H. D. (Atomic Energy Establishment, Trombay (India)). 1965. 69p. Dep. mn.

Various physics aspects of the Prototype Power Reactor Project are discussed. PPR is a heavy water moderated Pu enriched reactor. There are 55 vertical channels in the core of which central 37 are cooled by $D_2O$. Outer 18 channels are available for development of various coolants and fuel elements. The fuel in the inner 37 channels is of CANDU type. All calculations were made on desk calculating machines. A number of problems were undertaken to obtain data for the feasibility and detailed design groups working on the reactor. (auth)

**45105** (AEET-252) FUEL CYCLES IN PHWR AND CANDU TYPE REACTORS. Rastogi, B. P.; Bhatia, H. K.; Nakra, A. N.; Srinivasan, K. R.; Subramanian, T. A. (Atomic Energy Establishment, Trombay (India)). 1966. 31p. (CONF-660524-17). Dep. mn.

From 2nd International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn.

Heavy water moderated reactors pressure vessel design and pressure tube design are being studied in India. The pressure vessel reactor is of the PHWR type developed in Sweden using hot moderator, but no pressure tubes. The pressure tube reactor is of the CANDU type using cold moderator and bidirectional fueling. Some physics aspects of Th utilization in these reactors are discussed. (auth)

**45106** (ANL-7249) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, AUGUST 1966. (Argonne National Lab., Ill.). Sept. 23, 1966. Contract W-31-109-eng-38. 97p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Various research developments during this period are reported for liquid-metal fast breeder reactors, general reactor technology, advanced systems research and development, and nuclear safety. (M.O.W.)

**45107** (CONF-660303, pp 1025-34) FUTURE CROSS SECTION NEEDS OF THE NUCLEAR POWER INDUSTRY. Snyder, Thoma M. (General Electric Co., San Jose, Calif. [Atomic Power Equipment Dept.]).

As the nuclear power industry grows to a position of dominance in the generation of electrical power, the industry needs for neutron cross section data will swing towards the goals of efficient utilization of the enormous by-product isotope production capacity, accurate measurement of nuclear fuel burnup performance using fission product isotope concentrations, meaningful monitoring of the radiation damage potential of fast neutron fluxes with convenient neutron threshold reactions, and a broad grasp of the nuclear properties of the actinides relevant to criticality and nuclear safety. These data needs are discussed in detail. (auth)

**45108** (BNWL-119) FORMULATION AND EVALUATION OF INSPECTION PROCEDURES FOR THE APPLICATION OF SAFEGUARDS TO THE YANKEE NUCLEAR POWER STATION. Granquist, D. P. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). July 9, 1965. Contract AT(45-1)-1830. 22p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Inspection and control procedures to prevent the loss or misuse of fissionable materials are studied for the Yankee reactor. Inspection procedures involving less than full time resident inspection depends upon a positive identification of fuel pieces through the total system and the absolute containment of neutrons to their intended use within the reactor. Fuel contained within the reactor is tamper proof during reactor operation, but identification methods are needed for fuel outside the reactor. No appreciable number of neutrons can be obtained external to the Yankee reactor. (H.D.R.)

**45109** (EURAEC-1673) DESIGN OF A PRESTRESSED CONCRETE CAISSON FOR A 1000 Mw(e) BOILING WATER REACTOR. Quarterly Report No. 3, January-March 1966. (Societe d'Etudes et d'Equipments d'Entreprises, Paris (France)). Apr. 1966. Contract 068-65-7-TEEF. 33p. (EUR-2864). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Work Performed under United States-Euratom Joint Research and Development Program.

A feasibility and optimization study of the prestressed concrete caisson for a 1000 Mw(e) boiling water reactor is described. This optimization produced the basic data to be used in the remainder of the study. It also describes the start of the next phases, phase 2 consisting of drawing up a reference design for the prestressed concrete caisson defined by the optimization, and phase 3 in which a working and experimental design for a mock-up of the caisson will be drawn up. A preliminary plan for tests on the mock-up and a study of the influence of lagging the outer wall of the caisson on the cooling circuit and the internal lagging are included. Details are given of reorientation of the study following fresh results on the isolation of the caisson. (auth)

**45110** (GEAP-4793) EVESR MARK III SUPERHEAT FUEL BUNDLE DESIGN. Ianni, P. W. (ed.) (General Electric Co., San Jose, Calif. Advanced Products Operation). Jan. 1965. Contract AT(04-3)-189. 72p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

The mechanical and thermal-hydraulic design of the EVESR Mark III nuclear superheat fuel bundles is described. Each of these fuel bundles contains four clusters of Incoloy-clad fuel rods. There are seven Incoloy-clad solid fuel rods per cluster. The EVESR core performance conditions with the Mark III fuel installed are described. Emergency cooling and other safeguards considerations are also discussed. (auth)

**45111** (HPR-68) HBWR QUARTERLY PROGRESS REPORT, APRIL TO JUNE 1966. (Institutt for Atomenergi, Halden (Norway). OECD Halden Reaktor Prosjekt). Aug. 1966. 105p.

The operation and research and development activities at the Halden Boiling Water Reactor are summarized. Information is included on operating statistics, heavy water status, performance and dimension changes of the main gasket for the main flange of the reactor vessel, time schedule for a typical shutdown with fuel handling, and performance of the fuel failure location system. The specificness was assessed for gamma thermometers, preparations were made for gamma scanning burnup measurements, and development of the burnup routine in the multigroup lattice parameter code was continued. Hydrodynamic coupling experiments were conducted with test assemblies IFA-14 and -15, hydrodynamic measurements of responses to power perturbations were made in the boiling loop, and the activities of the joint Scandinavian hydrodynamics working group are reported. The fuel irradiation program is described, including extensive observations of flow instabilities in forced circulation assemblies. Development of tubular fuel, calibration of IFA-15, burnout detector development, and modification of inlet turbine geometry are summarized, and the neutron detector test assembly IFA-39 is described. (H.D.R.)

**45112** (IDO-17168) EFFECTS OF METAL-WATER REACTIONS ON THE LOSS-OF-COOLANT ACCIDENT. Jensen, S. E. (Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.). Aug. 1966. Contract AT(10-1)-205. 105p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

In conjunction with a proposed change in fuel cladding material from stainless steel to Zircaloy-4 for the LOFT reactor, an analysis was made of the potential effects of metal-water reactions associated with this new material on the loss-of-coolant test. In performing this analysis an approach to the problem was developed which is significantly different from that frequently employed in safety analysis of power reactors in that it is based upon the rate-limiting mechanism which control the reaction and permits the calculation of the rate and extent of the reaction as functions of space and time. In this way, a more realistic description of the course of metal-water reactions and how they can affect the loss-of-coolant accident can be obtained. Accounting for the time variation of the rate and extent of the metal-water reaction allows an examination of the effects of the reaction with respect to time and magnitude in relation to the loss-of-coolant accident. The rate-limiting phenomena, particularly steam availability, tend to reduce the rate at which the reaction can occur, thus spreading the reaction and its associated energy release over a longer period of time. The magnitude of the consequences of the metal-water reaction as a function of time is generally reduced when the reaction occurs over a longer time span as more time is available to absorb or dissipate energy. This approach and its basis, and the potential effects of a metal-water reaction using this approach are examined. Because of its fundamental basis, this type of analysis may be generally applicable to reactor systems other than LOFT; therefore, the discussions are general in nature, and various situations not directly related to LOFT are examined. Several areas in the analysis where significant improvement may be possible are also discussed. (auth)

**45113** (NAA-SR-11440) IRRADIATION BEHAVIOR OF UNALLOYED HYPOSTOICHIOMETRIC URANIUM CARBIDE EXPERIMENT AI 3-11 AND REVIEW. Frank, J. E.; Forrester, R. E.; Buck, J. S. (Atomics International, Canoga Park, Calif.). July 15, 1966. Contract AT(11-1)-Gen-8. 49p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

As part of the Large Sodium Graphite Reactor (LSGR) Development Program, uranium carbide fuels have been subjected to considerable study at Atomics International over the past several years. One phase of this work concerned itself with the study of the in-pile performance of hypostoichiometric uranium carbide. Included are the results of in-pile tests conducted to date for temperature, burnup, power conditions, and UC fuel compositions consistent with LSGR program requirements. More specifically, it deals with the results of the AI 3-11 experiment, which was successfully irradiated at LSGR conditions ($1600^\circ F < T_{\text{Centerline}} < 1800^\circ F$) to a peak burnup level of 30,000 Mwd/MTU. The results of the AI 3-11 experiment, along with previous tests: (1) demonstrate the feasibility of utilizing hypostoichiometric uranium carbide fuels, sodium bonded to Type 304 stainless steel cladding, under LSGR conditions to burnup levels of at least 30,000 Mwd/MTU, (2) indicate the fuel volume increases are directly proportional to burnup, to at least 30,000 Mwd/MTU, and (3) suggest UC fuel volume changes are composition dependent. (auth)

**45114** (NP-16272) DRAGON HIGH TEMPERATURE REACTOR PROJECT SEVENTH ANNUAL REPORT, 1965–1966. (Organization for Economic Co-Operation and Development, Paris (France)). 132p. Dep. mn.

Progress is reported on the Dragon Project for the period April 1, 1965 to March 31, 1966. Research and development activities included fuel particle coating processes and characteristics, fuel irradiation, graphite irradiation, graphite corrosion, carbon deposition on steel, coolant processing, engineering research, and engineering design and construction. The section on operation of the reactor experiment describes the performance through the various stages, the modifications required, the relevant physics and chemistry, and the progress in the ancillary production and examination activities. In the assessment study for a Dragon-type power reactor, a final design for a 540 Mw(e) plant was selected. Preliminary engineering and fuel-cycle studies are presented which indicate a low capital and low fuel-cycle system can be achieved. The section on administration of the project includes staff changes, contract activities, financial data, and information exchange activities. (H.D.R.)

**45115** (NYO-3250-7) CONNECTICUT YANKEE SET POINT STUDY. Mangan, M. A. (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). June 1966. Contract AT(30-1)-3250. 127p. (WCAP-2948). Dep. mn. CFSTI $4.00 cy, $0.75 mn.

For Connecticut Yankee Atomic Power Co., Haddam.

Work that formed the basis for the definition of a consistent set of control system set points to be used during initial plant tests and operation of the Connecticut Yankee plant is described. These set points are based on maintaining adequate control system performance over the whole range of predicted plant operating conditions. Effort is also made to present an insight into the predicted control system performance under various plant conditions. Control system performance is predicted for more probable or "best estimate" plant design parameters for various times throughout core lifetime and may be indicative of what may be expected under actual plant operation. The sensitivity of control system performance to various control parameter set points is also indicated to give the operator a feel for possible adjustments in control system parameters to improve certain aspects of plant transient response. (auth)

**45116** (ORNL-3996) DESIGN STUDIES OF 1000-Mw(e) MOLTEN-SALT BREEDER REACTORS. Kasten, Paul R.; Bettis, E. S.; Robertson, Roy C. (Oak Ridge National Lab., Tenn.). Aug. 1966. Contract W-7405-eng-26. 181p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Design and evaluation studies were made of thermal-energy molten-salt breeder reactors (MSBR) in order to assess their economic and nuclear performance and to identify important design and development problems. The reference reactor design presented is related to molten-salt reactors in general. The reference design is a two-region two-fluid system, with fuel salt separated from the blanket salt by graphite tubes. The fuel salt consists of $UF_4$ dissolved in a carrier salt of Li and Be fluorides, and the blanket salt contains $ThF_4$ dissolved in a similar carrier salt. The energy generated in the reactor fluid is transferred to a secondary coolant-salt circuit, which couples the reactor to a supercritical steam cycle. On-site fuel-recycle processing is employed, with fluoride-volatility and vacuum-distillation operations used for the fuel fluid, and direct-Pa-removal processing applied to the blanket stream. The resulting power cost for the reference plant, termed MSBR(Pa), is less than 2.7 mills/kwh(e); the specific fissile-material inventory is only 0.7 kg/Mw(e), the fuel doubling time is about 13 years, and the fuel-cycle cost is 0.35 mill/kwh(e). The associated power doubling time based on continuous investment of bred fuel is less than 9 years. (auth)

**45117** (ORNL-TM-1194) CORE DESIGN AND CONTAINMENT COST STUDY FOR GAS-COOLED FAST REACTOR STUDIES. Hoskins, R. E. (Oak Ridge National Lab., Tenn.). Sept. 1966. Contract W-7405-eng-26. 127p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

Some of the supporting analytical work performed at Oak Ridge National Laboratory to develop concepts of gas-cooled fast breeder reactors is presented. Heat transfer calculations are given for the various core configurations considered, and these configurations are compared on the basis of specific power and pumping power requirements. Some alternate fuel designs are discussed, one of which is the concept of coolant circulating inside tubes that are surrounded by fuel. Thermal bowing and flow-induced vibrations in fuel pins are analyzed. Optimization studies of secondary containment are also included. (auth)

**45118** (RISO-M-434) ATOMKRAFTVAERKERNES BRAENDSELSFORSYNINGSPROBLEMER 1970–1985. (A Preliminary Investigation of the Problems Involved in the Supply of Natural and Enriched Uranium to Users During the Period 1970–1985). Mehlsen, S.; (and others) (Danish Atomic Energy Commission, Risoe. Research Establishment). June 1966. 159p. Dep. mn.

The problems involved in supplying natural and enriched U to the power reactors that will be commissioned during the period 1970-1985 are investigated. Two cases are considered. Calculations based on the assumption that all new power stations will use light water reactors indicate a considerable acceleration in the mining and enrichment industries will be needed and fuel costs may rise to the point where they would no longer be competitive with conventional fuels. Assuming only heavy water reactors will be used, only half the accelerated demand on the mining industries will be necessary and there will be no need to expand the enrichment industries. The price of U is estimated to increase to $15 per lb $U_3O_8$ during the 1970-1985 period. (H.D.R.)

**45119** (SWRI-1228-7-34) INVESTIGATION OF THE FABRICATION AND INSTALLATION OF THE LACBWR REACTOR PIPING SYSTEM. Watson, Paul D. (Southwest Research Inst., San Antonio, Tex.). Aug. 12, 1966. Contract AT(11-1)-1228. 37p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Reviews of component specifications and design are presented along with results of inspections for contractor compliance. It is concluded that the LACBWR piping system and its components were fabricated and installed in a satisfactory manner and that all applicable specifications and code requirements were met. (J.R.D.)

**45120** (SWRI-1228-7-35) TENSILE AND IMPACT PROPERTIES OF LACBWR REACTOR VESSEL PLATE AND CONTROL MATERIAL. Norris, E. B. (Southwest Research Inst., San Antonio, Tex.). Aug. 12, 1966. Contract AT(11-1)-1228. 15p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Test results on Charpy V-notch and tensile specimens for LaCrosse Boiling Water Reactor pressure vessel materials are reported. These specimens were tested before and after irradiation. Data are included on the radioinduced nil ductility transition temperature and Charpy V-notch fracture energies. (J.R.D.)

**45121** (TID-23320) GARIGLIANO NUCLEAR POWER PLANT OPERATION REPORT FOR THE 4TH QUARTER OF 1965. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). Dec. 31, 1965. 16p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The plant was in shutdown condition throughout the period Oct. 1 to Dec. 31, 1965, for replacement of the stainless steel fuel channels and maintenance service. Scheduled maintenance included inspection of the turbine, generator, and heaters 3 and 4. Additional maintenance found necessary included cleaning all the fuel in the core, and plant startup operations were interrupted to repair a leak in one of the reactor drain pipes. (H.D.R.)

**45122** (TID-23321) GARIGLIANO NUCLEAR POWER PLANT OPERATION REPORT FOR THE 1ST QUARTER OF 1966. (Ente Nazionale per l'Energia Elettrica, Rome (Italy)). Mar. 31, 1966. 7p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The plant remained shut down during the reporting period to perform repair work on the reactor drainage system and to recover pieces of the broken poison sparger ring lying on the bottom of the reactor. Maintenance work on heaters Nos. 3 and 4 was completed. (H.D.R.)

**45123** (TID-23338) QUARTERLY REPORT NO. 14 [ON REACTOR ENGINEERING], OCTOBER 1-DECEMBER 31, 1965. (Societe d'Energie Nucleaire Franco-Belgo des Ardennes, Chooz-Lez-Givet (France)). Feb. 28, 1966. 27p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Further research developments on the SENA reactor are described with respect to design studies, prefabricated components, on-site work, tests, work schedule, and documentation. (M.O.W.)

**45124** (TID-23339) QUARTERLY REPORT NO. 15 [ON REACTOR ENGINEERING], JANUARY 1-MARCH 31, 1966. (Societe d'Energie Nucleaire Franco-Belge des Ardennes, Chooz-Lez-Givet (France)). 19p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Further research developments on the SENA reactor are described with respect to design studies, prefabricated components, and on-site work. (M.O.W.)

**45125** (WAPD-PWR-TE-203) PWR CORE 2 SEED 1 FLUX WIRE MEASUREMENTS FROM COLD, BEGINNING OF LIFE THROUGH THE FIRST XENON TRANSIENT TEST. Barr, K. P. (Bettis Atomic Power Lab., West Mifflin, Pa.). Oct. 7, 1965. Revised June 17, 1966. Contract AT-11-1-GEN-14. 53p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

Flux wire measurements of axial and radial activation distributions under varying reactor conditions are evaluated. Comparisons of the measured and calculated values indicate that the nuclear design calculational model used as the basis for core performance predictions provides adequate flux distributions for most reactor conditions. (H.D.R.)

**45126** (WCAP-6072) CHEMICAL EVALUATION OF YANKEE CORE I FUEL CLADDING CORROSION PRODUCTS. Picone, L. F.; Taylor, G. R. (Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.). Aug. 1966. Contract AT(30-1)-3017. 68p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

Chemical evaluations were performed to establish the distribution, composition, and activity of corrosion products on the stainless steel cladding after irradiation in one and two cores of the Yankee reactor. The effects of accumulated corrosion products and occluded poisons are discussed with respect to core reactivity losses and thermal performance. Corrosion product values are compared with mathematical solutions for plant activation processes, and effective activation cross sections are calculated for major activity precursors. In-core corrosion products are determined to have originated mainly at out-of-core sources, demonstrating the mobility of corrosion films and deposits. (auth)

**45127** (ORNL-tr-1228) THE PRESTRESSED CONCRETE CONTAINMENTS IN THE EDF3 AND EDF4 NUCLEAR POWER PLANTS. Lamiral, G.; Courbon, J. Translated for Oak Ridge National Lab., Tenn., from Ann. Inst. Tech. Batiment Trav. Publ., Suppl., 18: No. 206, 208-32(1965). 48p. Dep. mn. JCL $4.60 fs, $1.64 mf.

The problems concerning the study and design of prestressed concrete containment shells for natural U-graphite-$CO_2$ reactors of nuclear power plants built by Électricité de France are considered. The conditions under which the problems pertaining to the building of these structures have been considered with regard to prestressed concrete construction and the auxiliary installation of the cooling and thermal insulation systems are defined. The solutions obtained to these problems are described. The results obtained should permit the construction of reactor containments with dimensions larger than EDF4 containment with good safety, operating at higher pressures and thus meeting the needs of nuclear engineering for future years. (auth)

**45128** MODEL STUDIES ON THE PROSPECTS AND CONSEQUENCES OF THE APPLICATION OF NUCLEAR ENERGY TO ELECTRICITY PRODUCTION. II. RESULTS. Harde, R.; Memmert, G. Atomwirtschaft, 11: 210-15 (May 1966). (In German).

In prognoses on the long term significance of nuclear energy more or less arbitrary assumptions for given hypotheses were made for the evaluation criteria of the various reactor types (for instance, cost of the current production, consumption of natural U, amount of Pu produced). Such assumptions can, however, be replaced by the restricted results of a plausible calculation model. The results of model studies on the type and capacity of new power plants are reported with respect to the lowest possible mean current production cost. (J.S.R.)

**45129** DEVELOPMENT HISTORY OF THE AVR REACTOR. Schulten, R. (Kernforschungsanlage, Juelich, Ger.). Atomwirtschaft, 11: 218-19(May 1966). (In German).

The AVR reactor is, as similar developments in Great Britain and in the USA, a new reactor concept. A characteristic of this gas cooled high-temperature reactor is the spherical fuel elements. The development of this reactor concept from the studies of integrated primary circuits, the selection of the coolant, and advantages of high temperatures to the development of the prototype are briefly reviewed. (J.S.R.)

**45130** WHY DOES THE AVR SUPPORT THE HIGH-TEMPERATURE REACTOR DEVELOPMENT? Cautius, W. (Arbeitsgemeinschaft Versuchsreaktor (AVR) GmbH, Duesseldorf, Ger.). Atomwirtschaft, 11: 220-1(May 1966). (In German).

The AVR (Arbeitsgemeinschaft Versuchsreaktor GmbH.) supports the high-temperature reactor concept because it permits the use of modern turbines and compact construction. This reactor type has a high thermal efficiency and high burnup, and it can be converted into a thermal breeder. (J.S.R.)

**45131** COMMITMENT OF THE AVR TO THE CONSTRUCTION OF THE REACTOR. Rohe, L. B. (Kaufmaennischer Geschaeftsfueher der AVR GmbH, Duesseldorf, Ger.). Atomwirtschaft, 11: 222-3(May 1966). (In German).

The commitment of the AVR to the construction of a high-temperature gas-cooled reactor is briefly outlined with an indication of the establishment of the AVR, initiation of the construction, and financing of the project. (J.S.R.)

**45132** PROBLEMS IN THE PLANNING AND CONSTRUCTION OF THE AVR RESEARCH NUCLEAR POWER PLANT. Mueller, H. W. (Brown Boveri/Krupp Reaktorbau GmbH, Mannheim, Ger.); Schweiger, F.; Stuermer, W. Atomwirtschaft, 11: 223-5(May 1966). (In German).

The design, construction, and erection of the AVR reactor can be used as an example of the problems that must be solved in the development of a completely new reactor type. Typical problems are illustrated by the selection of the basic concept, site selection, new developments, and testing. (J.S.R.)

**45133** COMPLETE INSTALLATION OF THE AVR REACTOR. Braun, H. (Abteilungsleiter der BBC/Krupp, Ruelzheim, Ger.); Cleve, U.; Knuefer, H.; Oberklus, J. Atomwirtschaft, 11: 226-31(May 1966). (In German).

A brief description is given of the AVR research nuclear power plant with its gas-cooled coated-particle high-temperature reactor. The principal characteristics of the reactor installation, the primary circuit, the nuclear auxiliary devices, the conventional power constituents, and the measurement and control devices are considered. (J.S.R.)

**45134** CHARACTERISTICS OF THE STRUCTURAL PLANT (AVR). Bellermann, W. (BBC/Krupp, Mannheim, Ger.); Nebgen, K.; Wittchow, G. Atomwirtschaft, 11: 231-4(May 1966). (In German).

The AVR research nuclear power plant consists of two sections, the machine house and the reactor building. The reactor building and its installation, radiation protection devices, and the pressure vessel are described. (J.S.R.)

**45135** FUEL ELEMENTS (AVR). Ehlers, K. (BBC/Krupp, Mannheim, Ger.); Marnet, C. Atomwirtschaft, 11: 237-9(May 1966). (In German).

An AVR fuel element consists of a hollow graphite sphere sealed with a screw stopper. It is filled with a matrix that contains highly enriched U in the form of coated U–Th dicarbide particles mixed with graphite powder and binder. The development, preparation, and testing of the fuel elements are described. (J.S.R.)

**45136** REACTOR PRESSURE VESSEL AND LOAD-BEARING INSTALLATIONS (AVR). Bellermann, W. (BBC/Krupp, Mannheim, Ger.); Schwiers, H. G. Atomwirtschaft, 11: 239-43(May 1966). (In German).

The activity of the primary circuit is contained in the reactor pressure vessel by two precautions; integrated construction and casing with a second pressure vessel. The construction materials used in the pressure vessel and the supporting installations are discussed. The characteristics of the vessel construction and of the supporting installations are described. (J.S.R.)

**45137** SPECIAL DEVICES OF THE AVR REACTOR. STEAM GENERATOR. Dering, W. (AVR GmbH, Juelich, Ger.); Sergejtschik, E. Atomwirtschaft, 11: 244-6(May 1966). (In German).

The steam generator of the AVR reactor is in the internal reactor vessel and is no longer accessible after startup. This places high requirements on its operational reliability. The construction of the steam generator and its mounting, control, and operational reliability are discussed. (J.S.R.)

**45138** SHUTDOWN EQUIPMENT (AVR). Fricke, W. (BBC/Krupp, Juelich, Ger.); Gnutzmann, H.; Handel, H.; Muser, W. Atomwirtschaft, 11: 246-8(May 1966). (In German).

The AVR reactor has shutdown equipment in which the shutdown rods and absorber are introduced into the core from below. Nevertheless the fast shutdown is operated by gravity. A free-falling counter rod pushes the shutdown rod into the core by means of a rack operation. The electromechanical drive permits startup to be carried out in small steps. Full-scale studies under reactor conditions were carried out to ensure the safe operation of the installation. (J.S.R.)

**45139** LOADING DEVICE (AVR). Bialuschewski, H. (AVR GmbH, Juelich, Ger.); Fricke, W.; Honecker, G.; Landwehr, H. Atomwirtschaft, 11: 249-52(May 1966). (In German).

The loading device of the AVR reactor is used to introduce and remove the spherical fuel elements, moderating elements, boron elements, and test elements from the reactor core. The function and construction of the device are described. (J.S.R.)

**45140** MEASUREMENT AND CONTROL DEVICES OF THE LOADING INSTALLATION (AVR). Jacquemin, J. (AVR GmbH, Juelich, Ger.); Pflueger, W.; Steffens, R.; Ziermann, E. Atomwirtschaft, 11: 252-5(May 1966). (In German).

The possibility present in the AVR reactor of a continuous exchange of the fuel concentrations of the core by additions of different spheres necessitates a system of measurement devices in combination with the loading installation. The devices must be able to count the spheres and differentiate between them. They must also be capable of making burnup measurements. The introduction of these measurement and control devices and their operation and programming are described. (J.S.R.)

**45141** COOLANT BLOWER (AVR). Scholz, U. (BBC/Krupp, Mannheim, Ger.); Volz, W.; Wegener, F. W. Atomwirtschaft, 11: 256-8(May 1966). (In German).

In the coolant circuit, He is forced through the reactor core by two parallel blowers. The blowers are horizontal at the upper part of the reactor vessel. A construction with oil-lubricated friction bearings was selected, in which the radial wheel is a fly wheel. The installation and construction of the blowers, the oil feed installation, and the electrical equipment are described. (J.S.R.)

**45142** HELIUM PURIFICATION INSTALLATION (AVR). Gilli, R. (AVR GmbH, Juelich, Ger.); Schoening, J.; Werner, L.; Weinlein, W. Atomwirtschaft, 11: 259-61(May 1966). (In German).

The monitoring of the He circuit is discussed and the function of the purification installation is described. A block diagram of the coolant circuit and of the first purification stage is given. The construction and operation of the purification installation is discussed. (J.S.R.)

**45143** SAFETY QUESTIONS AND SAFETY DEVICES (AVR). Hennings, U. (BBC/Krupp, Mannheim, Ger.); Wohler, J.; Wolfram, B. Atomwirtschaft, 11: 262-4 (May 1966). (In German).

A rigid safety philosophy formed the bases for all precautions in the protection of personnel and environment. Special safety devices were proposed against incidents in the reactor core, against damage of the pressure vessel, and against accidents in the steam generator. (J.S.R.)

**45144** PHYSICS OF THE AVR REACTOR. Drechsel, W. (BBC/Krupp, Juelich, Ger.); Ivens, G.; Schatz, A. Atomwirtschaft, 11: 265-7(May 1966). (In German).

The physical behavior of the AVR reactor is essentially determined by the spherical fuel elements which contain graphite moderator in addition to the fissionable and breeder materials. The neutron physics system was calculated essentially with a two-group diffusion theory, by transport theory methods. Since no definite channels for the coolant gas flow are available, there are special problems in the calculation of the temperature distribution. The expected physical behavior in the nuclear startup, in the first full-load operation, and in stationary power operation are described. (tr-auth)

**45145** STARTUP AND OPERATION TESTING (AVR). Bromkamp, K.-H. (BBC/Krupp, Juelich, Ger.); Cleve, U.; Hantke, H.-J.; Schweiger, F. Atomwirtschaft, 11: 267-8 (May 1966). (In German).

The startup program for the AVR is outlined and the experiments to be carried out in this operational phase are discussed. (J.S.R.)

**45146** EXPERIMENTS WITH INSTALLATION PARTS (AVR). von der Decken, C. B.; Hantke, H.-J.; Rausch, W. (BBC/Krupp, Juelich, Ger.). Atomwirtschaft, 11: 269-71 (May 1966). (In German).

For the development and construction of the AVR reactor many experiments were carried out on installation constituents in order to determine the best installation procedures and to learn the long-time behavior under operating conditions. These experiments were concerned principally with the mechanics of the particle coating, the loading installation, the gas flow and heat transfer coefficients, burnup measurements, shutdown rods, and the thickness and behavior of the deposits in the He circuit. (J.S.R.)

**45147** PRINCIPLE OF BREEDERS. Haefele, W. (Kernforschungszentrum, Karlsruhe, Ger.). Atomwirtschaft, 11: 290-3(June 1966). (In German).

The transition from normal nuclear reactors to breeder reactors permits a better utilization of the U reserves. The course of the breeding process and the fuel element cycle of fast breeder reactors are outlined. (J.S.R.)

**45148** KARLSRUHE FAST BREEDER PROJECT. Haefele, W. (Kernforschungszentrum, Karlsruhe, Ger.). Atomwirtschaft, 11: 293-302(June 1966). (In German).

The Karlsruhe fast breeder project was instituted in 1960. Two types of fast breeders are being studied, a Na-cooled reactor and a steam-cooled reactor. The subcritical and zero-power experiments performed on these two reactor concepts are described. The fuel element development and fuel element cycle are outlined. Reactor development studies on Na cooling and steam cooling are reviewed. (J.S.R.)

**45149** CONTRIBUTION OF INDUSTRY TO THE FAST BREEDER PROJECT WITH SODIUM COOLING. Guthmann, E. (INTERATOM, Bensberg, Ger.); Held, Ch. Atomwirtschaft, 11: 302-4(June 1966). (In German).

The preliminary experiments and studies made by industry on the Na-cooled breeder reactor are reviewed. The development of the 300-Mw Na prototype is outlined. (J.S.R.)

**45150** CONTRIBUTION OF INDUSTRY TO THE FAST BREEDER PROJECT WITH STEAM COOLING. Amon, F.; Kilian, P. (Allgemeine Elektricitaets-Gesellschaft, Grosswelzheim, Ger.). Atomwirtschaft, 11: 305-7(June 1966). (In German).

The industrial development program for a prototype of the steam-cooled fast breeder reactor is outlined. The construction of the installation, safety, physics, and thermodynamics are considered. (J.S.R.)

**45151** PLUTONIUM SUPPLY OF THE GERMAN FAST BREEDER PROTOTYPE REACTORS. Gupta, D.; Jansen, P.; Seetzen, J. (Kernforschungszentrum, Karlsruhe, Ger.). Atomwirtschaft, 11: 310-13(June 1966). (In German).

The procurement and processing of Pu for the fast breeder prototype reactors are analyzed on the basis of a market price in the case of excess availability or insufficiency of Pu. A cost analysis is made of the processing capacities and costs. (J.S.R.)

**45152** THORIUM BREEDERS. Oldekop, W. (Siemens-Schuckertwerke AG, Erlangen, Ger.); Schulten, R. Atomwirtschaft, 11: 314-15(June 1966). (In German).

Thorium breeder reactors are considered from the viewpoint of the breeding process, the fuel element cycle, and the economics. (J.S.R.)

**45153** HEAVY WATER REACTOR AS A THORIUM BREEDER. Oldekop, W. (Siemens-Schuckertwerke AG, Erlangen, Ger.). Atomwirtschaft, 11: 316-17(June 1966). (In German).

With heavy water-moderated reactors economic fuel element costs can be obtained without high burnup because of their good neutron economy and relatively low fuel element fabrication costs. Present studies indicate that $D_2O$ cooling is the most suitable for a $D_2O$ thorium breeder. Light water reactors can compete with pressure vessel reactors up to 450 Mw(e), but at higher outputs a prestressed concrete pressure vessel or a transition to a pressure tube concept is necessary and advantageous. (tr-auth)

**45154** HIGH-TEMPERATURE REACTOR AS BREEDER. Schulten, R. (Kernforschungsanlage, Juelich, Ger.). Atomwirtschaft, 11: 318-19(June 1966). (In German).

The thorium high-temperature reactor can be used as a breeder by supplementary developments: installation of a breeder blanket, more frequent fuel exchange, and additional processing methods. The development of coated particles as fuel elements has made the high temperature reactor more attractive as a breeder. Three stages for the development of the high temperature reactor into a breeder are outlined. (J.S.R.)

**45155** EPITHERMAL FUSED-SALT THORIUM BREEDER. Moretti, P. M.; Schmidt, R. (INTERATOM, Bensberg, Ger.). Atomwirtschaft, 11: 319-20(June 1966). (In German).

The use of fused fluoride salts of Th and U permit a reduction of the number of intermediate stages in the breeding and fuel element cycle of a Th breeder and leads to lower fuel element costs. In Germany the fused salt Th breeder is being investigated using two reactor concepts: direct contact cooling with lead sprinkler and the salt in fuel rod claddings. (J.S.R.)

**45156** OPERATIONAL EXPERIENCE WITH BREEDING REACTOR EBR-II SERIES OF THE AMERICAN BREEDER REACTOR PROGRAM. Monson, H. O. (Argonne National Lab., Ill.). Atomwirtschaft, 11: 321-5 (June 1966). (In German).

The operation experience obtained with the EBR-II reactor and with the Fermi reactor are briefly outlined. Studies made for a 1000-Mw(e) fast breeder are indicated. (J.S.R.)

**45157** BREEDER REACTOR DEVELOPMENT IN FRANCE. Sahl, W.; Wustner, R. (CEA-EURATOM, Cadarache, France). Atomwirtschaft, 11: 325-9(June 1966). (In German).

The characteristics of the French breeder reactor program are given. The development and construction of the Rapsodie reactors are outlined. The utilization of the Rapsodie reactors as irradiation reactors is discussed. The development and construction of a larger prototype are discussed. (J.S.R.)

**45158** FROM THE DFR TO THE PFR: OPERATION, RESEARCH PROGRAMS, AND DEVELOPMENT OF THE BRITISH FAST BREEDER REACTORS. Matthews, R. R. (Dounreay Experimental Reactor Establishment, Caithness, Scotland). Atomwirtschaft, 11: 330-4(June 1966). (In German).

The Dounreay Fast Reactor is described. The results of a year's operation of the reactor with respect to fuel elements and reactor control are reported. These experiences have led to studies of $PuO_2$ and PuC fuel elements and to the projection of a 250 Mw(e) prototype fast reactor. (J.S.R.)

**45159** DEVELOPMENT OF FAST BREEDER REACTORS IN THE SOVIET UNION. Engelmann, P. (Kernforschungszentrum, Karlsruhe, Ger.). Atomwirtschaft, 11: 335-6(June 1966). (In German).

The breeder reactors of the Soviet Union are based on sodium-cooled reactors. The prototype BN-350 is described and a program for the improvement of its economy is outlined. (J.S.R.)

**45160** COMPACT SODIUM-COOLED NUCLEAR REACTOR INSTALLATION AT KARLSRUHE (KNK). Harde, R.; Stoehr, K. W. (INTERATOM, Bensberg, Ger.). Atomwirtschaft, 11: 354-60(July 1966). (In German).

The compact sodium-cooled reactor installation at Karlsruhe possesses many characteristics for realization of a fast breeder reactor. The reactor installation is described in detail with consideration of its construction characteristics, plant layout, reactor design, control rods, fuel element handling, heat transfer systems, steam power installation, and control systems. (J.S.R.)

**45161** PERT PLANNING IN THE GUNDREMMINGEN ATOMIC POWER PLANT. Wirp, A. (Allgemeine Elektricitaets-Gesellschaft, Frankfurt am Main). Atomwirtschaft, 11: 361-5(July 1966). (In German).

In the construction of the Gundremmingen nuclear power plant, the PERT (Program Evaluation Review Technique) method was used for the time analysis. In the use of PERT the planning is separated into two distinct phases: the formulation of a lattice planning diagram in which the structure of the project is investigated and the actual time analysis through which the individual work through the net plan of necessary time needs is arranged. Results of the calculations are given using the KRB nuclear power plant as an example. (J.S.R.)

**45162** FUEL HANDLING SYSTEM OF THE DON REACTOR. CONSTRUCTION AND EXPERIMENTATION OF HOOK MECHANISM. Palomero, C. Fernandez; Trueba Bellido, P.; Alvarez De Buergo, L. (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid), 10: 100-14(Mar.-Apr. 1966). (In Spanish).

The study of the loading device of the DON reactor was reduced to two phases: study of the hook system of the fuel elements similar to that working in the PIQUA reactor and study of the hermetic seal system of the fuel channel and its adaptation to the loading installation in steady-state operation. The experimental program developed for the testing of the systems is outlined. The hook and its operation are described in some detail. (J.S.R.)

**45163** BUILDING A POWER CELL FOR THE FUEL HANDLING MACHINE FOR THE DON REACTOR. Alvarez de Buergo, L.; Trueba Bellido, P.; Palomero, C. Fernandez (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid), 10: 219-34(May-June 1966). (In Spanish).

The basic concepts and design philosophy necessary in order to build power cells and associated measuring equipment for the fuel handling machine for the DON reactor are presented along with the experimental results obtained up to this time. (G.O.Y.)

**45164** EXPERIENCE FROM THE EXPERIMENTAL OPERATION OF THE HALDEN HEAVY WATER BOILING REACTOR (HBWR). Rose, Roar. Energ. Nucl. (Paris), 8: 238-45(June 1966).

The Halden boiling water reactor, a joint project of the O.E.C.D. began to operate in 1959. A great deal of information has come from this operation. It was sought to determine the cause of leaks and the deterioration of the heavy water (moderator), and the breakage of fuel elements with the release of fission products. Methods for coping with these incidents were tested. The instruments installed in the core allow the study of the operating characteristics. Other studies concern the dynamic characteristics of this type of reactor, the behavior of fuels under radiation, the operation at high specific powers, the deterioration of the heavy water and the possibilities of avoiding it. The future test program, with the continuation of the fuel radiation tests, provides for the study of the behavior of the fuel at high temperatures and the design of the instruments. (auth)

**45165** CONDITIONS FOR THE DEVELOPMENT OF ADVANCED TYPE REACTORS IN THE EUROPEAN COMMUNITY. Gueron, J. Energ. Nucl. (Paris), 8: 246-9 (June 1966). (In French).

The contributions made by community research to the development of reactors are discussed: work done in the past; work to be done; its role and the possibilities of working with industry for the design of new reactors, and especially for the development of prototypes. (auth)

**45166** ECONOMICS AND THE FUTURE OF ATOMIC ENERGY. Andriot, M. Energ. Nucl. (Paris), 8: 250-9 (June 1966). (In French).

The main points examined concern the technics presently developed in the United States, Great Britain and France: the reasons for the choice and the long-term predicted developments, the economic future: examples of the French technique using natural U, and the American technique using enriched U, the place of nuclear energy in the energy programs in France and in the Europe of the Six especially, and the long-term nuclear programs for which two possibilities are considered: the development of breeders (secondary reactors); the improvement of primary reactors and the use of converters. The broad outline of the French program is given. (auth)

**45167** THE REACTOR TANK OF THE BEZNAU NUCLEAR POWER STATION. Berniolles, Jean (Societe des Forges et Ateliers du Creusot, Paris). Ind. At., 10: No. 5-6, 89-91(1966). (In French).

The pressure vessel of the Beznau pressurized water reactor is made of forged steel and sheets covered with steel slightly alloyed with Mo and Mn. The construction, transportation, and erection of this tank are briefly described. (J.S.R.)

**45168** ANALYSIS AND SIMULATION OF THE ENRICO FERMI POWER PLANT. Clark, D. R. (Bailey Meter Co., Wickliffe, Ohio). ISA (Instr. Soc. Amer.), Proc., Nat. Power Instr. Symp., 7: 115-27(1964).

A description of the analysis and analog computer simulation of the reactor and coolant loops for the Enrico Fermi Nuclear Power Plant is given. The purpose of this work was to study coolant loop interaction, and to verify the proposed control systems for the reactor and coolant loops. Typical system equations and method of approach for the simulation are given as well as analog computer runs showing system behavior. (auth)

**45169** CONSTRUCTION PROBLEMS IN MODERATOR VESSELS. Gsell, R. (Gebrueder Sulzer AG, Winterthur, Switzerland). Neue Tech., 8: 118-29(June 1966). (In German).

Welding and design problems in the construction of the Lucens reactor moderator vessel are examined. Design studies are also presented for a moderator vessel in connection with the UmG Project for a Swiss nuclear power station of 250 Mw(e). (H.D.R.)

**45170** PEACH BOTTOM ATOMIC POWER STATION. Koutz, Stanley L. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Nucl. News, 9: No. 8, 21-3 (Aug. 1966).

The Peach Bottom atomic power station physical plant and the reactor fuel elements, control, cooling, and maintenance are briefly described. Unique features of a proposed, large high temperature gas-cooled reactor similar to Peach Bottom are discussed. (H.D.R.)

**45171** THE MAGNOX STATIONS: A SUCCESS STORY. **Gibbs, K. P.; Fair, D. R. R. (Central Electricity Generating Board, London). Nucleonics, 24: No. 9, 48-53 (Sept. 1966).**

The development of magnox reactors is described. The first magnox reactor went critical 5 years ago, and now magnox units produce 1 out of every 13 kw generated in the UK and have led to second-generation plants that will have power costs 10% below those using coal. The origins of the program, magnox station design, commissioning, operational experience, and the second power program are discussed. (J.F.P.)

**45172** FAST REACTORS: ON THE LINE BY '71. **Frame, A. G. (United Kingdom Atomic Energy Authority, Risley, Eng.); Matthews, R. R. Nucleonics, 24: No. 9, 54-9 (Sept. 1966).**

Fast breeder reactor development in the United Kingdom is considered. Experience with fast reactors, the prototype fast reactor, and fast reactor economics is covered. The fast breeder promises capital costs comparable with thermal reactors, and a potential for lower fuel costs and self-sufficiency. It is considered that this may lead to 20,000 Mw(e) of fast reactor capacity in the United Kingdom by the end of the century. (J.F.P.)

**45173** SGHWR: A DARK-HORSE COMPETITOR. **Cartwright, H. (United Kingdom Atomic Energy Authority, Risley, Eng.). Nucleonics, 24: No. 9, 60-3; 73 (Sept. 1966).**

The SGHWR development, design, and construction are discussed. The primary coolant circuit is described and shown, and a cross section of the calandria is given showing channel tubes, loops, and other facilities. Floodable tubes are fitted into interlattice positions and can be used to displace $D_2O$ from the core to adjust the moderator/fuel ratio for experiments. (J.F.P.)

**45174** TEMPERATURE-ENTHALPY DIAGRAM HELPS ANALYZE NUCLEAR REACTOR STEAM SYSTEMS. Lutz, D. E. **(Argonne National Lab., Ill.).** Power, 110: No. 8, 76-7 **(Aug. 1966).**

The usefulness of temperature-enthalpy diagrams for analyzing nuclear reactor steam systems is illustrated. The analysis helps the designer to compare possible variations in steam generator heat transfer areas, pump and pump sizes, and overall plant efficiency. It also identifies temperature differences throughout the heat exchanger sections, and so points up potential thermal stress problems. (L.B.S.)

**45175** OUTLOOK FOR CENTRAL-STATION NUCLEAR POWER IN THE UNITED STATES. **Hogerton, John F. Cambridge, Mass., Arthur D. Little Inc., 1964. 61p.**

An attempt is made to forecast the cost of nuclear power relative to that of power from fossil fuels (notably coal) and thereby to estimate the growth of central-station nuclear power in the United States over the period 1964 to 1980. The dramatic progress recently reflected by published estimates for the Oyster Creek nuclear power project on the one hand, and by recent unit-train reductions in the cost of transporting coal on the other, raises questions that warrant an effort to develop answers. An analysis is made that leads to the forecast that nuclear power will be capturing between 10 and 15% of the new steam-electric plant market at the start of the 1970's and about 35% of that market as the industry enters the 1980's. A total of 64,000 megawatts of installed nuclear power capacity by 1980 is projected, by which time the volume of reactor component manufacture will approximate $300 million annually and that of nuclear fuel supply operations will be roughly twice this amount. U. S. utilities will by then have invested upward of $9 billion in nuclear power plants and something like $4 billion in nuclear fuel inventories. What is perhaps most significant about the present status and expected near-future growth of nuclear power is that it provides electric utilities in virtually all power regions with a new competing energy source and thereby gives them an added degree of freedom in plant decisions and added leverage in fuel supply negotiations. The indirect benefits of this on the U. S. electric energy economy will probably far exceed the direct benefits of nuclear plant construction over the period in question. Nuclear power does not create much in the way of a new demand for power equipment, since most components of a nuclear reactor have their counterparts in conventional steam boiler systems; however, it may result in significant changes in the equipment supply pattern. Perhaps of greatest interest, from a business standpoint, is the present and possible future pattern of nuclear fuel supply operations. (auth)

**45176** APPROACH TO THE PHYSICS OF THORIUM LOADED BERYLLIA MODERATED REACTORS. **Gemmell, W.; Pollard, J. P.; Symonds, J. L. (Australian Atomic Energy Commission, Lucas Heights, New South Wales). 14p. (CONF-660524-7). ORAU. Gmelin,** AED-CONF-66-104-7.

**From 2nd International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn.**

The approach taken in the experimental and theoretical physics studies within the Australian Atomic Energy Commission Physics Division is presented. The study is centered on a pebble bed type reactor using $BeO-ThO_2-PuO_2$ fuel spheres. (B.G.D.)

**45177** ENERGY TRANSPORTATION COSTS AND THEIR EFFECT ON THE MARKET FOR NUCLEAR POWER IN CANADA. **Clayton, G. W. (Canadian Nuclear Association, Toronto). 32p. (CONF-660516-4). ORAU. Gmelin, AED-CONF-66-138-3.**

**From Annual Conference on Organic and Heavy Water Reactors, Winnipeg, Canada.**

The costs of transporting the various forms of fossil fuels are examined to determine to what extent further economies might be effected and hence, to establish the approximate lower limit of the cost of these fuels when used to fire thermal-electric generating stations. Some attention is also given to the cost of fuel production and to the capital cost of fossil-fuel fired thermal-electric generation, in order to determine those areas in Canada where nuclear power may be competitive, and the general order of costs that must be attained if this competition is to become effective. (auth)

**45178** ECONOMIC USE OF NUCLEAR POWER IN EXPANDING UTILITY SYSTEMS. **Johnson, C. M. (General Electric Co., San Jose, Calif.); Marsh, W. D. 15p. (CONF-660429-2). ORAU. Gmelin, AED-CONF-66-098-10.**

**From American Power Conference, 28th Annual Meeting, Chicago.**

Investigations of nuclear power economics for the next 20 years by means of simulation studies of electric utility generating systems are reported. The question of whether the "next" plant addition should be nuclear or fossil is considered within the framework of a mixed expansion pattern. The simulation studies reported for a 3100 Mw utility system show that the next unit could be nuclear over a wide range of fossil plant capital and fuel costs. Annual system cost differentials become favorable to nuclear for the next unit within 4 or 5 years of initial operation of the unit. (L.B.S.)

**45179** UNITED KINGDOM NUCLEAR POWER PROGRAM. **Stewart, J. C. C. 14p. (CONF-651132-8; TRG-Report-1169). ORAU. Gmelin, AED-CONF-65-337-30.**

**From Atomic Industrial Forum, 12th Annual Conference, Washington, D. C.**

Some views are presented on the present status and future developments in the over all nuclear power program of the United Kingdom. The choice of gas-cooled reactors and prospects for fast breeder reactors are discussed. (L.B.S.)

**45180** ENRICHED URANIUM FUEL CYCLES. **Allday, C.; Taylor, H. A. (United Kingdom Atomic Energy Authority, Risley, Eng.). 18p. CONF-178-6). ORAU.**

From European Atomic Energy Society's Symposium on Fuel Cycles for Power Reactors, Baden-Baden, Ger., Sept. 1963.

A unified treatment of the technical aspects of the nuclear fuel cycles planned for the Advanced Gas Cooled and Steam Generating Heavy Water Reactor systems is presented and the economic factors relating to the utilization of the British fuel cycle facilities are discussed. The production of low enriched U oxide fuel from U ore, fuel fabrication, reprocessing of irradiated fuel, and re-utilization of U and Pu are described and the relationship of the heat output of a reactor system to fuel management within the reactor and the overall fuel cycle is discussed. (auth)

**45181** NUCLEAR POWER PLANT RELIABILITY. Creagan, R. J. Pittsburgh, Westinghouse Electric Corp., 1966, Paper No. 31PP66-489, 34p. (CONF-660708-5). ORAU.

From IEEE Summer Power Meeting, New Orleans.

The reliability of nuclear power plants is discussed. The development of water reactors from the first power reactors to the presently planned large reactors is described with listings of nuclear power plants and predictions of future power output. The performance of nuclear plants and fuel is described and listed with more detailed information on specific Westinghouse pressurized water reactor plants. The reliability analysis is applied to the nuclear fuel to give an indication of reliability with the associated confidence level. The experience indicates excellent performance. (J.F.P.)

**45182** APPROACHING NUCLEAR POWER. Chittenden, W. A.; Nathan, A. New York, Inst. of Electrical and Electronics Engineers, 1966, Paper No. 31PP66-487, 17p. (CONF-660708-2). ORAU.

From IEEE Summer Power Meeting, New Orleans.

Some representative aspects associated with the integration of nuclear energy into the planning of a utility system are briefly discussed. Site criteria including water, site location and size, and transportation, schedules including plant licensing regulations, public relations, and personnel and training requirements including plant staff and the training program are covered. (J.F.P.)

**45183** WHITESHELL NUCLEAR RESEARCH ESTABLISHMENT NOW AND IN THE FUTURE. Mooradian, A. J. 16p. (CONF-660516-13). ORAU.

From Annual Conference on Organic and Heavy Water Reactors, Winnipeg, Can.

A brief summary is given of the reasons for the existence of the Whiteshell establishment, past and present accomplishments, and future research and development programs. (C.E.S.)

**45184** WORLD AND CANADIAN ENERGY: TODAY AND TOMORROW. PART II. Magrath, N. A. (H. G. Acres and Co. Ltd., Niagara Falls, Ont.). 20p. (CONF-660110-2). ORAU. Gmelin, AED-CONF-66-029-2.

From Canadian Electrical Association Eastern Zone Meetings, Halifax, Nova Scotia.

The state of the art in the development of energy sources other than nuclear and conventional hydro is discussed. Methods of increasing the efficiency of energy extraction from fossil and nuclear fuels are also discussed. Thermionic conversion and fuel cells are briefly reviewed. (G.O.Y.)

**45185** FUEL CYCLE INVESTIGATIONS FOR A DOR-TYPE REACTOR. Oelgaard, P. L. (Danish Atomic Energy Commission, Riso). 20p. (CONF-178-11). ORAU.

From European Atomic Energy Society's Symposium on Fuel Cycles for Power Reactors, Baden-Baden, Ger., Sept. 1963.

Optimization studies on organic-cooled heavy water reactors are discussed. Based on optimized values it is felt that indefinite-period storage of spent fuel is preferred over chemical processing. Fuel enrichment should be in the range 1 to 1.25 at. %. Closed-core $UO_2$ lattices appear advantageous. (J.R.D.)

## Process Heat Reactors

*Refer also to abstract 43195.*

**45186** (NP-16148) POTENTIALITIES AND POSSIBILITIES OF DESALTING FOR NORTHERN NEW JERSEY AND NEW YORK CITY. (Office of Saline Water, Washington, D. C.). June 1966. 112p.

The Northeast water supply situation and the drought problem are reviewed. Large dual-purpose, nuclear-fueled desalting plants of 300 MGD capacity can be built as a long-range solution to the need for additional water supply. Alternative water supplies, such as the Hudson River and small desalting plants, are discussed and found to be adequate for the present. However, additional desalting studies are needed. (D.L.C.)

**45187** DESALINATION TODAY AND TOMORROW. Streifler-Shavit, I. E. (Joint Sea-Water Desalting Project, Israel). Euratom Bull., 5: 66-72(Sept. 1966).

Present desalination processes and cost estimates for each are discussed. Desalination processes include electrodialysis, reverse osmosis, freezing, and evaporation. The best economic prospect is the construction of large combined plants in which nuclear energy is used to produce electricity and fresh water. A large nuclear dual-purpose plant is described and nuclear fuels are compared with fossil fuels. (F.S.)

**45188** POWER PLANT CYCLES FOR DUAL-PURPOSE PLANT APPLICATIONS. Wilson, J. R.; Finke, J.; Platz, H. R. (Kaiser Engineers, Oakland, Calif.). 24p. (CONF-660546-2). ORAU. Gmelin, AED-CONF-66-111-3.

From American Society of Civil Engineers, Water Resources Engineering Conference, Denver, Colo.

The economic and technical advantages of using extraction or exhaust steam from a nuclear power steam plant as a heat source for desalting water is discussed. The dual-purpose electric power–water desalting plant in Israel is described to illustrate these advantages. (B.G.D.)

**45189** NUCLEAR POWER-WATER DESALTING PLANT AND THE ELECTRIC UTILITY INDUSTRY. Stinson, W. H.; O'Toole, J. D. (Westinghouse Electric Corp., Pittsburgh). 26p. (CONF-660429-4). ORAU. Gmelin, AED-CONF-66-098-5.

From American Power Conference, 28th Annual Meeting, Chicago.

The principles and status of technology of nuclear steam supply systems are reviewed; typical ranges of energy costs from such systems are presented; and some unique turbine-generator configurations and their influence on costs of energy supplied to the water desalting plant are discussed. In addition, the possibility of reactor "stretch" utilization and need for overall optimization in dual-purpose plants are discussed. (L.B.S.)

## Production Reactors

*Refer also to abstract 45215.*

**45190** (DP-670) COMPACT ACTUATOR SYSTEM FOR REACTOR CONTROL. Goodwin, Leslie E.; Ross, John D. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). Mar. 1962. Contract AT(07-2)-1. 14p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A control rod actuator system for a large production reactor is described. This system would eliminate the need for the long latches used in the present reactors at the Savannah River Plant. The actuator package, which is designed to drive a seven-rod cluster, is approximately 8½ in. in diameter and 19 ft high. The new design would allow the actuators to be mounted on a movable platform in the reactor room. The design of a control system for use with the actuator package is outlined. (auth)

**45191** (RL-GEN-1058) DATA PROCESSING APPLICATIONS TO A LARGE, DUAL-PURPOSE NUCLEAR RE-

ACTOR. Leiby, D. W.; Poor, C. F.; Hayner, C. T. (General Electric Co., Richland, Wash. Hanford Atomic Products Operation). July 1, 1966. Contract AT(45-1)-1350. 38p. (CONF-660606-19). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From American Nuclear Society Meeting, Denver, Colo. The N-Reactor was designed as a multi-purpose plant capable of producing various nuclear isotopes as well as providing steam to drive two 400 Mw(e) turbine-generators. The large amounts of information generated during the fabrication of fuel elements and during the operation of the plant require the application of digital computer techniques to satisfy both short-term and long-term data requirements. For example, coolant process limits must be calculated for each of the 1003 fuel channels. Likewise, a data system must be provided for rapid retrieval of information on any one or all of thousands of fuel elements charged in the reactor. The methods now being utilized to meet these data processing needs and the steps being taken to further enhance the information processing capabilities are described. (auth)

## Propulsion and Space

### See also ENGINEERING — Space Propulsion

**45192** (CONF-660303, pp 88-90) THE SENSITIVITY OF SNAP REACTOR CALCULATIONS TO UNCERTAINTIES IN THE ZIRCONIUM ABSORPTION CROSS SECTION. Ottewitte, Eric H. (Atomics International, Canoga Park, Calif.).

About 30% of the atoms in the hydrogen-moderated, $^{235}$U fueled SNAP reactor cores are zirconium. Reported values for the infinitely dilute zirconium resonance absorption integral (0.4 ev to 2 Mev) have ranged from 3.7 barns to more recent estimates of about $0.9 \pm 0.3$ barns. A large component of this integral may be present in the 300 ev resonance. This has been assumed in several cross-section libraries. The worth of zirconium absorption per barn at 300 ev in a SNAP $U\text{-}ZrH_{1.7}$ reactor is 3.0% $\Delta k/k$ (by multigroup transport theory code calculation). Assuming the uncertainty in the resonance integral to be 0.3 barns, the uncertainty in a SNAP reactor calculation would then be $\pm 0.9\%$ $\Delta k/k$, without considering the degree of resonance self-shielding. With proper treatment of the self-shielding it would be less. The value of the resonance self-shielding will depend on whether the absorption resonance integral is distributed over the resonance energy range or whether it is concentrated in a single resonance such as the 300 ev resonance. This reactivity uncertainty becomes important when one attempts to analyze reactors markedly different from those for which experimental information is available. (auth)

**45193** (CONF-660303, pp 204-9) EFFECTS OF PREPOISON CROSS SECTION UNCERTAINTIES ON SNAP REACTOR PERFORMANCE. Birney, K. R.; Hawley, J. P.; McGoff, D. J. (Atomics International, Canoga Park, Calif.).

The statically controlled SNAP reactor utilizes a balance between operational reactivity loss and reactivity insertion from burnout of an initially loaded prepoison to maintain relatively constant reactor power and temperature during the reactor lifetime. No active reactor control is provided after an initial reactor stabilization period of a few days to allow completion of xenon and hydrogen redistribution reactivity transients. Uncertainties in cross sections result in uncertainties in the reactor temperature which is governed by the negative temperature coefficient of the reactor. Most of this effect can be attributed to the prepoison cross sections. During the SNAP 10A Demonstration Test and SNAPSHOT flight test, an error in prediction of the Samarium-149 cross section introduced larger-than-predicted temperature decreases during lifetime. Although this error was caused primarily by spectral effects rather than errors in pointwise cross section data, the same uncertainties are introduced by cross section uncertainties when poisons having less well-known cross sections are used. Poisons presently under consideration include isotopes of gadolinium and europium. The particular isotope or combination to be used is determined by reactor power and temperature. (auth)

**45194** (NAA-SR-11924) DEVELOPMENTAL IRRADIATION TEST OF SNAP-8 ELECTRICAL COMPONENTS (HF-8). Davies, N. F. (Atomics International, Canoga Park, Calif.). July 15, 1966. Contract AT(11-1)-Gen-8. 23p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Results of irradiation tests to determine the effects of the SNAP operating environment on the performance of connectors, cables, and electric insulation specimens for use in the SNAP 8 reactor are presented. Results indicate that with proper cleanliness standards and vacuum conditions, most inorganic insulation systems are not severely affected by high-temperature, radiation, and vacuum environments. The suitability of electrical components for use in the S8DS reactor system was proved. (J.R.D.)

**45195** (NAA-SR-Memo-11819) DRUTES: A CODE TO CALCULATE THE DESIGN POINTS OF AN UNMANNED, DIRECT-RADIATING, THERMOELECTRIC SYSTEM. (NAA PROGRAM DESCRIPTION). Bramblett, E. L.; Van Osdol, J. H. (Atomics International, Canoga Park, Calif.). Apr. 20, 1966. Contract AT(11-1)-Gen-8. 86p. Dep. mn. CFSTI $3.00 cy, $0.75 mn.

DRUTES provides a rapid means of determining system weights, sizes and performance information for unmanned nuclear thermoelectric power systems, which utilize the SNAP 8 and 10B reactors and direct radiating SiGe thermoelectric converters. In addition, methods are provided for optimizing systems for a given electrical power level to yield minimum system weight. The components included in the calculations are the reactor-reflector assembly, gamma and neutron shields, converter-radiator, support structure, NaK piping, and dc conduction pumps and buses. (auth)

**45196** (NAA-SR-Memo-11894) UPSTART: DIGITAL COMPUTER CALL PROGRAM. Winson, R. W. (Atomics International, Canoga Park, Calif.). June 10, 1966. Contract AT-11-1-GEN-8. 222p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

The UPSTART digital program was conceived and developed to evaluate the transient response of the various SNAP reactor systems under development and study. The code was designed to maintain the computational speed and ease of use of a special purpose code and yet have the flexibility of a general purpose digital program, to evaluate the transient response of SNAP reactor systems during startup and normal operation, and to evaluate system safety criteria. It was further desired to use the code to design and evaluate various reactor control systems and the performance of new system concepts and components. (auth)

**45197** (NAA-SR-Memo-11971) WEIGHT SCALING FACTORS FOR SNAP REACTOR SHIELDS. Hedgecock, J. L.; German, G. E. (Atomics International, Canoga Park, Calif.). June 8, 1966. Contract AT-11-1-GEN-8. 14p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

A series of weight scaling factor graphs are presented for the following basic shield configurations: instrument-rated shadow shields, man-rated shadow shields, and man-rated four-pi shields. Each graph shows the weight ratio of a new shield design with respect to a base case design as a function of one parameter. The parameters for which the weight ratios are given include reactor power, dose rates, and the principal overall dimensions. Each parameter is considered to be essentially independent of the other parameters, thus the total weight ratio for a new design is the product of the weight ratios for the individual parameters. Shield weights for each of the base case designs are given. (auth)

**45198** (NAA-SR-Memo-11977) DOLTL: A COMPUTER CODE TO CALCULATE TEMPERATURE DRIFT FOR STATICALLY CONTROLLED SNAP 10A TYPE REACTORS. Swenson, L. D.; Birney, K. R. (Atomics International, Canoga Park, Calif.). Apr. 11, 1966. Contract AT(11-1)-Gen-8. 15p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The analytical model used in the DOLTL computer code to calculate the temperature drift for SNAP 10A reactors is presented. The model allows an active control period of specified length followed by static (hands off) control for the remainder of the operating period. The model treats the following mechanisms of reactivity change as a function of power and/or temperature: $^{149}$Sm prepoison burnout and fission product $^{149}$Sm buildup, $H_2$ leakage from the fuel elements, $H_2$ redistribution within the fuel elements, fission product accumulation (other than $^{135}$Xe and $^{149}$Sm) and $^{235}$U depletion, and changes in equilibrium $^{135}$Xe worth. (auth)

**45199** THEORETICAL AND EXPERIMENTAL PHYSICS STUDIES OF TUNGSTEN BASED NUCLEAR ROCKETS. Butler, D. K.; Doerner, R. C.; Knapp, W. G.; Loewenstein, W. B. (Agronne National Lab., Ill.). New York, American Inst. of Aeronautics and Astronautics, 1966, Paper No. 66-586, 8p., $1.50. (CONF-660608-8). ORAU.

From 2nd AIAA Propulsion Joint Specialist Conference, Colorado Springs.

Physics studies in support of the design of a W metal based, $UO_2$ fueled, Be reflected rocket reactor are reported. Two lines of study were followed. The first was designed to provide basic information for understanding the neutronic properties of this type of reactor. A series of critical assemblies, each differing from its predecessors in only one significant way, provided parameters important to rocket applications. W based cores fueled by U metal and simulated $UO_2$ with reflectors of Al, $Al_2O_3$, and BeO were included. Measurements included critical dimensions, fission and reaction rates, spatial reactivity-worth distributions, and neutron lifetimes. Material replacement experiments for fissile and core structural material (e.g., W and Re) as well as a variety of other materials of interest represented a major effort. Calculations in conjunction with the experimental work emphasized the assembly of nuclear data and the testing of the calculational techniques with diffusion and transport theory in both one and two dimensions. The second line of study was in direct support of the design effort. It included calculation of the properties of proposed systems and the development of simplified calculational techniques for use in combined engineering and physics parametric studies. (auth)

**45200** DESIGN OF A NUCLEAR PROPULSION MODULE. McKereghan, Charles D. (Lockheed Missiles and Space Co., Sunnyvale, Calif.). New York, American Inst. of Aeronautics and Astronautics, 1966, Paper No. 66-548, 14p., $1.50. (CONF-660608-10). ORAU.

From AIAA Second Propulsion Joint Specialist Conference.

A multipurpose nuclear stage, designed for a broad range of mission applications, is described. This stage, launched by an uprated Saturn V, can be used either directly in lunar support and deep-space missions or, through orbital rendezvous and assembly, in manned interplanetary flight. Criteria for this modular vehicle and the resultant stage design are developed. The stage employs such features as meteoroid protection and superinsulation system required for the long-term storage in space associated with the interplanetary mission while providing sufficient performance gains to be attractive as a third-stage booster for the short-duration missions. The design of the propulsion module provides for an alternate configuration, a propellant module, that is used in a connecting mode to allow meeting the gross propellant requirements of the manned interplanetary mission vehicles. Designs of the necessary docking and assembly structures used in building up the overall interplanetary launch vehicle are presented, as is the transfer stage used to deliver the modules from the phasing to the assembly orbit. The performance characteristics of the nuclear propulsion module are discussed and scaling laws are derived so that general mission analyses can be performed. (auth)

**45201** MHD SPECIES SEPARATION IN A GASEOUS NUCLEAR ROCKET USING A TIME VARYING TRAVELING WAVE ELECTROMAGNETIC FIELD. Rashad, A. R. M. (Memphis State Univ., Tenn.). New York, American Inst. of Aeronautics and Astronautics, 1966, Preprint No. 66-499, 11p., $1.50. (CONF-660632-4). ORAU.

From American Inst. of Aeronautics and Astronautics, 4th Aerospace Sciences Meeting, Los Angeles, Calif.

The first part of a series of studies concerning a suggested method for the separation of the $^{235}$U fuel from the $H_2$ propellant in a gaseous nuclear rocket is presented. The species are separated by magnetohydrodynamically spinning the plasma in a cylindrical vortex, using a time varying traveling wave electromagnetic field. The interaction of the plasma induced currents with the magnetic field, produces the azimuthal $\vec{J} \times \vec{B}$ force required to rotate the plasma and separate the $^{235}$U fuel from the $H_2$. (auth)

## Research and Test Reactors

*Refer also to abstracts 43668, 43791, and 45157.*

**45202** (ANL-6964) BORAX-V NEUTRONICS. Hagen, J. I.; Goin, R. W. (Argonne National Lab., Idaho Falls, Idaho). Dec. 1965. Contract W-31-109-eng-38. 96p. Dep. mn. CFSTI $4.00 cy, $0.75 mn.

The BORAX-V design characteristics are briefly summarized and the development of boiling core and superheater fuel geometry is described. Reactivity effects entering into the design are examined and the calculational procedures employed in obtaining constants are designated. Studies on control-rod effects, perturbations due to boron poison rods, flux-flattening methods, and various other items are also outlined. Experimental measurements with four distinct cores are compared to the calculations. Approximations in few-group reactor-physics calculations, superheater-boiler coupling, and a TDC calculation of the BORAX-V exponential experiment are also described. (H.D.R.)

**45203** (DP-1045) THE DETERMINATION OF AXIAL FLUX AND AXIAL EXPOSURE DISTRIBUTIONS IN THE HWCTR. Gorrell, Thomas C. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.). June 1966. Contract AT(07-2)-1. 28p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

Methods were developed to calculate axial flux distributions from a knowledge of control rod position and fuel exposure during full-power nuclear operation of the HWCTR. The maximum specific power, heat flux, and core temperature of each fuel assembly were determined from the flux distributions to ensure safe operation of the reactor. Also, methods were developed to compute the axial exposure distribution of fuel assemblies as required for evaluation of the irradiation performance of each test fuel design. (auth)

**45204** (ORNL-P-2410) REMOTELY OPERATED EQUIPMENT FOR FABRICATING HFIR TARGET ELEMENTS. Preston, M. K.; Sease, J. D.; Van Cleve, J. E. Jr.; Lotts, A. L. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 29p. (CONF-661001-23). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From 14th Conference on Remote Systems Technology, Pittsburgh, Pa.

The target element, which is composed of 35 actinide oxide-aluminum powder pellets clad with an Al tube contained in a target sheath, is fabricated by techniques that embrace powder-metallurgical, welding, metal-forming and inspection procedures. Equipment was developed to carry out all steps in the process in three hot cells in the ORNL Transuranium Processing Facility. All development stages have been successfully completed, and a portion of the equipment has been operated with radioactive material. (auth)

**45205** (ORNL-P-2491) THE OAK RIDGE HIGH FLUX ISOTOPE REACTOR, DESIGN AND INITIAL OPERATION. Cole, T. E. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 32p. (CONF-660925-1). Dep. mn. CFSTI $2.00 cy, $0.50 mn.

From Seminar on Intense Neutron Sources, Santa Fe, N. Mex.

A summary description is presented of the general features of the HFIR facility. The startup program, development, construction, and operating costs, experimental program plans, and possibilities for achieving a higher neutron flux are discussed. (H.D.R.)

**45206** (ORO-3191-1) SYMPOSIUM ON THE UTILIZATION OF RESEARCH REACTORS, NOVEMBER 7-9, 1963, ATLANTA, GEORGIA. (Georgia Inst. of Tech., Atlanta). Contract AT(40-1)-3191. 194p. (CONF-559). Dep. mn. CFSTI $2.00 cy, $1.00 mn.

Included are 15 papers dealing with various aspects of research reactor utilization in the fields of biomedical research, chemistry research, physics research, and other broad research programs. (M.O.W.)

**45207** (EURFNR-76F) DETERMINATION OF THE NEUTRONIC VALUES OF SODIUM-COOLED FAST REACTORS WITH THE SNEAK-2 ASSEMBLY. Durand-Smet, R. (Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik). Translation of report KFK-382. 52p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Work Performed under United States-Euratom Fast Reactor Exchange Program.

The theoretical and practical problems which arise in the simulation of large fast breeder reactors are described. The technique of two-zoned assemblies, effects of material inhomogeneity, methods of calculation, and the possibility of simulating reactor material by a mixture of two cheap materials are investigated. The SNEAK-2 assembly is described and its neutronic properties (criticality factor, extrapolated dimensions, reactivity worth of materials at the center of the assembly) are indicated. The Na-reactivity coefficient is investigated, and the local danger coefficient, the void-coefficient, and the density-coefficient of Na in the core are defined and calculated. A one-dimensional diffusion program, a 16-group set, and a 26-group set were used to calculate these neutronic values in spherical or cylindrical geometry. (H.D.R.)

**45208** EXPERIMENTAL STUDIES OF THE INFLUENCE OF NONUNIFORM FUEL DISTRIBUTION ON THE HEAT RATE IN REACTORS. Glushkov, E. S.; Ponomarev-Stepnoi, N. N. At. Energ. (USSR), 20: 478-82(June 1966). (In Russian).

The question of shaping of the heat output was investigated on a critical assembly with BeO moderator and fuel element of enriched U. The assembly had a nonuniform distribution of enriched U in the space, guaranteeing a given distribution of the energy output per unit volume of the active zone and a uniform heat distribution per unit mass of the fuel. Experimental values of the distribution of the neutron flux and the heat output and size of the effective multiplication coefficient satisfactorily agrees with the calculated data obtained by solution of the multigroup equation. (tr-auth)

**45209** REACTOR FUEL TEMPERATURE AND THERMAL TIME CONSTANT MEASUREMENTS WITH TUNGSTEN-RHENIUM THERMOCOUPLES. Brooks, Edward J. (Argonne National Lab., Idaho Falls, Idaho). ISA (Instrum. Soc. Amer) Trans., 5: 217-22(July 1966).

The BORAX-V boiling-water nuclear reactor, with integral steam superheater, was instrumented with different types of sensors capable of monitoring physical conditions within the 600-psig reactor vessel. Measurement of central temperatures in individual $UO_2$ boiler fuel rods during reactor operation was made with W/W-26% Re thermocouples. These thermocouples were also used to determine thermal conductance values of the fuel rods through steady-state and transient temperature tests performed on the thermocouple fuel rods. Time response of the thermocouples, in the fuel-rod environment, was also determined by these transient tests. Evaluation of thermocouples, advanced in design from those initially used in the above reactor tests, has been made. The potential use of this newer thermocouple design at temperatures approaching 5000 F, in protective atmospheres, is discussed. (auth)

**45210** PROBLEMS OF TREATING AND TESTING FUEL ELEMENTS WITH REGARD TO THE POWER INCREASE OF THE ROSSENDORF EXPERIMENTAL REACTOR. Adam, E.; Westphal, D. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.). Kernenergie, 9: 191-3(June 1966). (In German).

After studying the initial conditions, a technique is proposed to improve the fuel elements of EK-10 type with regard to their thermodynamic properties. Some difficulties and the results of simple tests of the modified fuel elements are discussed. (auth)

**45211** HIGH FLUX BEAM RESEARCH REACTOR. Nucl. Energy, 197-200(July-Aug. 1966).

A brief survey is given of the dedication ceremonies, the reactor and building design, experimental facilities, and computers for the 40-Mev heavy-water moderated and cooled High Flux Beam Research Reactor at Brookhaven. (L.B.S.)

**45212** BUILDING OF THE TRIGA REACTOR AT LJUBLJANA. Bernot, Natan; Gabrovsek, Zdravko. Nukl. Energ., 1: 2-10(1966). (In Yugoslavian).

A brief account of the reactor and the experimental equipment is followed by a presentation of the progress made in the building of the reactor hall and the other facilities at Podgorica. The problems connected with the building of the reactor are described in more detail. Particular attention is given to the various organizational and technical problems characteristic for construction undertaken jointly with foreign suppliers. In addition to the description of the manufacture of the aluminium tank and the other reactor components, the concreting of the biological shield is presented, as well as the assembly of the mechanical equipment and the electronic instrumentation. Preparations for the operation and the use of the reactor are also described. (auth)

**45213** SOME INVESTIGATIONS INTO APPLICATION OF PSEUDO-RANDOM BINARY SIGNALS TO REACTOR DYNAMICS MEASUREMENTS. Hara, M.; Suda, N. (Japan Atomic Energy Research Inst., Tokyo). 37p. (CONF-660206-17). ORAU. Gmelin, AED-CONF-66-014-16.

From Symposium on Neutron Noise, Waves, and Pulse Propagation, Gainesville, Fla.

Experiments and analyses pertinent to the application of random and pseudo-random binary signals to reactor dynamics measurements are described. The discussion includes the method of synthesizing the particular type of pseudo-random binary signal, preliminary experiments on JRR-3 with analog data acquisition and processing systems, and the effect of external noise on the statistical accuracy of the results. The digital system used in recent experiments, and a comparison of different methods of data reduction are also described. It is concluded that the digital data acquisition and processing is more favorable than analog. (J.F.P.)

# WASTE DISPOSAL AND PROCESSING

**See also** BIOLOGY AND MEDICINE — Ecology.
CHEMISTRY — Radiochemistry.
CHEMISTRY — Separation Processes and Procedures.
HEALTH AND SAFETY.

*Refer also to abstract 43539.*

**45214** (AEET-243) INCINERATION OF LOW-LEVEL RADIOACTIVE SOLID WASTES AND GAS CLEANING: SOME OPERATIONAL EXPERIENCES. Thomas, K. T.; Khan, A. A.; Amalraj, R. V. (Atomic Energy Establishment, Trombay (India)). 1966. 20p. Dep. mn.

A 54-lb/hr active waste incinerator has been in use since 1963 for the treatment of alpha-contaminated waste. A 100-lb/hr incinerator plant of improved design was set up in 1965. Both plants have gas-filtering systems. The designs and operational details of the plants are discussed. (D.L.C.)

**45215** (BNWL-282) THE REDUCTION OF REACTOR EFFLUENT WATER RADIONUCLIDES BY THE ADDITION OF SODIUM SILICATE TO PROCESS WATER: 105D HALF PLANT ADDITION. Robertson, D. E. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). Aug. 1966. Contract AT(45-1)-1830. 14p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

Research and development on the reduction of radionuclides discharged to the Columbia River in reactor effluent is described. Sodium silicate as $SiO_2$, was added to the process water supplying ½ of the D Reactor at an average concentration of 15 ppM, which gradually reduced the radionuclide concentration entering the Columbia River. After the 8th month an equilibrium condition was reached, and the levels of $^{76}$As, $^{51}$Cr, $^{239}$Np, $^{32}$P, $^{124}$Sb, and $^{64}$Cu were lowered by factors of about 9.0, 7.0, 6.0, 3.0, 3.0 to 5.0 and 1.5 respectively. Concentration of $^{65}$Zn remained unchanged. The only significant increases were due to $^{24}$Na, and trace amounts of $^{140}$La and other rare earth elements. Cobalt-60 and $^{46}$Sc behaved erratically. The studies suggest that if sodium silicate were used on a full scale (5 reactor basis), river concentration of radionuclides could be proportionally reduced. (F.S.)

**45216** (ORNL-3721) STATUS REPORT NO. 5 ON CLINCH RIVER STUDY. Morton, R. J. (ed.) (Oak Ridge National Lab., Tenn.). Oct. 1965. Contract W-7405-eng-26. 152p. Dep. mn. CFSTI $5.00 cy, $1.00 mn.

Radioactive contamination of the Clinch and Tennessee River systems from April 1962 to December 1963 is reviewed. Data are included on radionuclide and stable-chemical analyses of water samples, sources of release of radionuclides to the Clinch River, core sampling of bottom sediments, behavior of radionuclides in river sediments, distribution of radionuclides in sediments, surveys of bottom sediments for radioactivity in Clinch River sloughs and in the Tennessee River, radioactivity in dredged material removed from the Clinch River during channel improvement, sampling and analysis of river fish, use of specific activities in predicting the uptake of $^{90}$Sr by fish, and the movement of fish in the vicinity of White Oak Creek. Data are also presented on hydrologic measurements and analyses, the cooperative program of the USGS, dispersion of radioactive materials in the Melton Hill Reservoir, dye-tracer studies, and safety evaluation studies. (R.C.K.)

**45217** (ORNL-P-2126) MODEL AND UNDERGROUND STUDIES OF THE INFLUENCE OF STRESS, TEMPERATURE, AND RADIATION ON FLOW AND STABILITY IN ROCK SALT MINES. Bradshaw, R. L.; Lomenick, T. F.; McClain, W. C.; Empson, F. M. (Oak Ridge National Lab., Tenn.). [1966]. Contract W-7405-eng-26. 18p. (CONF-660927-1). Dep. mn. CFSTI $1.00 cy, $0.50 mn.

From International Society of Rock Mechanics, 1st International Congress, Lisbon, Portugal.

Pillar-model tests are described. These tests are useful for understanding the way in which salt movements take place, and it is expected that the predictions based on the elevated temperature models will be valid also. No measurable effects of radiation on the flow of salt was expected, and none were observed during the first 50 days of operation of the demonstration. Thermal expansion of the floor, and increased transverse expansion rates in the pillars adjacent to the array rooms, were about as expected. The acceleration of movement in the ceiling (separation of a 2-ft-thick salt layer) exceeded that which was anticipated from the thermal effects in the floor; however, the magnitude of the movement was such that no trouble was expected from this source during the operation of the demonstration. In an actual operation, movements of this magnitude (or even greater) should not cause trouble during the time when a room is being filled with radioactive waste. After the room is filled, it is anticipated that it will be backfilled with crushed salt. The increased roof movement does indicate, however, that an extra margin of stability must be allowed in the initial design of the waste disposal facility. (auth)

**45218** (KFK-tr-201) UNTERSUCHUNGEN UEBER DIE ENTWAESSERUNG RADIOAKTIVER SCHLAEMME. (Dehydration of Radioactive Slimes). Ishiyama, T.; Matsumura, T.; Mamuro, T. Translated into German by Peter Buriks (Kernforschungszentrum, Karlsruhe, Ger.), from Radioisotopes (Tokyo), 12: 277-84(1963). 16p. Dep. mn. JCL $1.60 fs, $0.80 mf.

The effects of the addition of polymers to radioactive slimes on the dehydration of these slimes by settling, filtration, and freezing with subsequent thawing were investigated. The slimes used were bentonite Konan-flock slime, calcium phosphate slime, and iron(III) hydroxide slime. The results showed that the greatest volume reduction was obtained in bentonite Konan-flock slimes by the addition of approximately 100 ppm polyoxyethylene followed by slow cooling to the freezing point and filtration after melting in vacuum. In calcium phosphate slime the best results were obtained by the addition of 1000 ppm Konan flock followed by slow cooling and filtration after melting in vacuum. For iron hydroxide slime a relatively fast cooling and filtration in vacuum after melting is recommended. The addition of a polymer has no effect. (J.S.R.)

**45219** ENVIRONMENTAL EFFECTS FROM OPERATION OF THE WASTE CALCINATION FACILITIES. Bunch, D. F. (Atomic Energy Commission, Idaho Falls, Idaho); Markee, E. H. Jr.; Jenson, D. K. Health Phys., 12: 1283-97(Sept. 1966).

Operation of the Waste Calcining Facility (WCF) at the National Reactor Testing Station in Idaho was initiated on 8 December 1963. As a result of 311 days of continuous operation, about 305 C of $^{106}$Ru and trace amounts of $^{90}$Sr, $^{137}$Cs, and $^{144}$Ce were released from a 73-m stack. In the calcining process, liquid radioactive wastes and an acid solution of aluminum nitrate are converted to solids. Most of the radioactive fission product oxides formed are solids at all operating temperatures. These are removed by various clean-up stages. The predominant form of ruthenium, $RuO_4$, however, is liquid or gaseous at these temperatures. Although absorbers removed 99.9% of the off-gas ruthenium, significant amounts were found in the

WCF off-gas. The variation of release rates observed at the stack (a maximum of $5.5 \times 10^{-4}$ μC/cm$^3$ and an average of $1.9 \times 10^{-7}$ μC/cm$^3$), with the exception of certain abnormal events occurring during and immediately following the calcining operation, was proportional to the levels of ruthenium in the liquid wastes being processed. Monitoring was conducted during and after operation of the WCF. This involved high-volume air samples fallout plates, and vegetation and soil samples. Significant amounts of $^{106}$Ru on vegetation were found as far as 16,000 m from the stack, with a maximum of $2.2 \times 10^{-3}$ μC/g at 1600 m. Comparison of these activities with concentrations of $^{106}$Ru in air indicates the deposition velocity was about 0.5 cm/sec. In order to more fully evaluate the impact of a calcining operation on the environment, a diffusion model has been formulated to predict integrated concentrations of radioactive materials resulting from the long term release from a single stack. The model presented utilizes daily source terms of $^{106}$Ru and hourly meteorological data. Comparison of model predictions with air sampling data and deposition data showed close correspondence. The results of these studies lead to the following conclusions: only the oxides with a very low boiling point were released in significant amounts. These release ratios were also quite low (an average reduction factor greater than $10^3$), from the limited verification data available, the dispersion model presented seems to be a reasonable approach and is useful for considering the long-term impact of continuous releases from an operating facility, native vegetation is adequate for monitoring purposes and provides an inexpensive and continuous record of the impact of radioactive releases on the environs, and there was no significant hazard from operation of the WCF. Calculations indicate that the total dose at the point of maximum integrated concentration was about 0.1 rad to the lung. (auth)

**45220** THE RADIOACTIVE LIQUID WASTE PROCESSING PLANT OF THE ROSPO AND ISPRA-2 REACTORS OF THE CENTER OF NUCLEAR STUDIES AT CASACCIA. Branca, Guido; Verri, Alessandro (CNEN, Casaccia, Italy). Ing. Sanit., No. 3, 1-8(1964). (In Italian). (RT/PROT(65)-6).

The basic organization of the recovery system for radioactive liquid wastes and the recovery plant for the Rospo and Ispra-2 reactors is described in detail. The type of waste from these reactors is also considered. Criteria for using the recovery system and treating radioactive wastes are illustrated. (J.S.R.)

**45221** RADIOACTIVE DECONTAMINATION BY SLURRYING WITH YAZOO AND ZILPHA CLAYS. Goldsmith, William A.; Middlebrooks, E. J. (Mississippi State Univ., State College). J. Amer. Water Works Ass., 58: 1052-62(Aug. 1966).

A dosage of approximately 1,100 mg/l of Yazoo clay effectively decontaminated $^{60}$Co; whereas the desired decontamination factor was not obtained with any dosage of Zilpha clay. Yazoo clay was ineffective for decontaminating $^{90}$Sr in a tap water substrate, perhaps because of its $CaCO_3$ content. Zilpha clay was effective for removing small amounts of $^{90}$Sr. Yazoo and Zilpha clays were equally effective for removing microquantities of $^{137}$Cs. Pretreatment of Yazoo and Zilpha clays by excessive heating for a prolonged period appears to reduce the effectiveness of these clays for removing $^{137}$Cs. The time required for these pretreated clays to settle out of suspension is much less than the time required for normal days. The decontamination factors and percentage removals obtained for the clay dosages used in the investigation, except Yazoo clay for $^{90}$Sr, exceeded the values obtained from comparable experiments involving other clays. The results indicated that Yazoo and Zilpha clays may prove to be economically more feasible than the clays now used commercially as adsorbers of radioisotopes. (F.S.)

**45222** RADIOACTIVE WASTES: THEIR TREATMENT AND DISPOSAL. Burns, R. H. (Atomic Energy Research Establishment, Harwell, England). 21p. (CONF-660523-3). ORAU. Gmelin, AED-CONF-66-182-1.

From 21st Annual Purdue Industrial Waste Conference, Lafayette, Ind.

Methods for treatment and disposal of all types and levels of radioactive wastes are surveyed. Special emphasis is placed on waste disposal in the United Kingdom. Wastes arising from reactor operation, fuel reprocessing, use of radioisotopes in industry and medicine, and from the radium industry are all briefly discussed. It was concluded that present methods of waste treatment and disposal are adequate. Certain other methods, such as foam separation, reverse osmosis, and electrodialysis are mentioned as now under investigation. (B.L.M.)

**45223** RADIOACTIVITY IN BOTTOM SEDIMENTS OF THE CLINCH-TENNESSEE RIVERS. Pickering, R. J.; Carrigan, P. H. Jr.; Tamura, Tsuneo; Abee, H. H.; Beverage, J. W.; Andrew, R. W. Jr. (Oak Ridge National Lab., Tenn.). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/4, 44p. (CONF-660507-6). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

Low-activity wastes are released from the Oak Ridge National Laboratory to the Clinch River via White Oak Creek. Part of the released nuclides eventually settle downstream in the bottom sediments in the Clinch-Tennessee Rivers. Analyses of sediment cores from a 21-mile reach of the Clinch River have shown that there are in the bottom sediments, as of 1 July 1962, 154.6 curies of $^{137}$Cs, 17.5 curies of $^{60}$Co, 15.5 curies of $^{106}$Ru, at least 10.2 curies of rare earths, and 2.9 curies of $^{90}$Sr. These quantities (decay taken into account) represent 21% of the $^{137}$Cs, 9% of the $^{60}$Co, 0.4% of the $^{106}$Ru, possibly 25% or more of the rare earths, and 0.2% of the $^{90}$Sr released to the river during the 20 years of laboratory operations. The total volume of radioactive sediment in the 21-mile reach was 84.8 million cubic feet. Approximately 95% of the identified radioactivity in the sediment occurs in the most-downstream 15 miles of the Clinch River in the backwaters of Watts Bar Dam. In the upstream, swifter-flowing portion of the reach, radioactive sediment was detected along the sides of the stream channel. The maximum concentration of radionuclides was found near the mouth of White Oak Creek, the point at which the wastes enter the river. Several sediment cores from the downstream section of the river showed the same general pattern of variation of gross gamma radioactivity with depth. This pattern resembled the pattern of annual laboratory releases of $^{137}$Cs, the most abundant radionuclide in the sediment. The vertical distribution of $^{60}$Co correlated strongly with that of $^{137}$Cs. It was concluded that $^{137}$Cs and $^{60}$Co were incorporated in the sediment by deposition of suspended radioactive solids which entered the river from White Oak Creek. Cation exchange properties of the sediment are largely controlled by its content of mica and clay minerals. Radioactive nuclides can be released from the sediments only with difficulty and under atypical conditions. (auth)

**45224** DILUTION, DISPERSION, AND SEDIMENTATION IN SOME BRITISH ESTUARIES. Lowton, R. J. (Central Electricity Generating Board, London); Martin, J. H.; Talbot, J. W. Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/11, 20p. (CONF-660507-10). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

Studies related to the disposal of effluents in a number of estuaries in Britain have been made. The effects of salinity and temperature distribution, wave transport, tidal range, fresh water inflow and bottom topography are discussed in relation to soluble effluents and sediments. Estuaries to which particular reference is made are the Severn, Blackwater, and the Solway Firth. In the Blackwater where large volumes of cooling water provide high initial dilution of the discharge, observations indicate the most important factors influencing the subsequent dispersal are the comparatively large tidal oscillations, the low river run-off and the presence of the mud flats. In the Solway Firth, the tidal current differential also exceeded other influences. Transfer and deposition of sediments vary markedly with the coarseness of the sediment, and these parameters affect the quantity of any radioactivity which may be adsorbed by the particles. Methods for estimating the effectiveness of the mixing and dispersal of estuarine water into the sea are considered, and the results compared. (auth)

**45225** POSSIBLE ENRICHMENTS OF DISTINCT RADIOACTIVE ELEMENTS IN RIVER MOUTHS. Kautsky, Hans (German Hydrographic Inst., Hamburg). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/9, 16p. (CONF-660507-8). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

Since 1961 a higher gamma activity has been noted on the bed of the River Elbe at its mouth near the lightships "Elbe 2" and "Elbe 1." Barium-140 and $^{95}$Zr were identified here among other radioactive isotopes. It was assumed that these elements originated from fallout and were transported to the sea by the Elbe, but the main sedimentation of suspended matter takes place not downstream but upstream from Cuxhaven, in the area of mixing between river and sea waters. In order to explain the intensified disposal of radioactive material in the outer Elbe 12-20 km downstream from Cuxhaven, it was assumed that: the radioactive elements of low solubility, e.g., Zr, Ba, Ce are mostly combined with the finer particles of suspended matter, and the finest particles of suspended matter are deposited mainly in the outer Elbe. The suspended matter of several cubic meters of water was separated at various places in the Elbe mouth by means of a continuous centrifuge and water and suspended matter were independently examined for radioactivity. Measurement of the concentration of slightly soluble $^{144}$Ce showed that a decrease in the radioactivity/l of water downstream was accompanied by a decrease in the suspended matter/l. The specific activity of $^{144}$Ce/g of suspended matter increased in the downstream direction. The highest $^{144}$Ce activity on the sea bottom was obtained near the lightship "Elbe 1." It was concluded that, of the radioactive fission products from fallout or from nuclear power stations transported into a river, the slightly soluble products may be enriched in limited areas at the mouth of the river. The biologically essential heavy metals belong to these elements. An increased radiation hazard may result for the marine fauna and flora of river mouths if fission products from nuclear power stations are transported into the river. (auth)

**45226** THERMITE PROCESS FOR THE FIXATION OF HIGH LEVEL RADIOACTIVE WASTES. Spector, Marshall L. 25p. (CONF-660320-10). ORAU. Gmelin, AED-CONF-66-051-21.

From American Chemical Society, 151st Meeting, Pittsburgh.

A continuous and batch process for fixation of high-level radioactive waste solutions involves reduction in volume of the radioactive feed solutions, conversion to an oxide or sulfate form, and finally reduction to an insoluble polysilicate by the appropriate thermite reaction. Flowsheets are described in detail for the thermite process beginning with either oxides or sulfates. The thermite approach to the ultimate disposal of radioactive wastes in the insoluble polysilicates product offers the following advantages: (1) leachability of the final product, (2) containment of volatile materials, (3) potential fixation of all radioactive materials in one product, and (4) adaptability of process to all anticipated waste feeds. (B.L.M.)

**45227** STUDY OF THE CONTENT OF LONG-LIVED FISSION-FRAGMENT RADIONUCLIDES IN THE BLACK SEA. Gedeonov, L. I.; Nelepo, B. A.; Yakovleva, G. V.; Maksimov, I. N.; Sysoeva, L. N.; Belyaev, L. I. (Radium Inst., Leningrad. Marine Hydrophysics Inst., Sevastopol). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/21, 10p. (In Russian). (CONF-660507-13). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

For studying the permissibility of disposing of radioactive wastes in the Black Sea, data on radioactive fallout from nuclear explosions were analyzed. The collection and isotopic analysis of the fallout were performed by the usual methods. The quantity of fallout products reaching the surface of the Black Sea during the period 1960 to 1964 is given. The total amount of $^{90}$Sr and $^{137}$Cs in the Black Sea was calculated with reference to the sea's hydrological regime, i.e., with reference to the contribution of radioactive fission products from the inflowing rivers and to the exchange through the Bosphorus between the Black Sea and the Sea of Marmora. In 1964 the amount of $^{90}$Sr and $^{137}$Cs in the Black Sea amounted to approximately 1.7 × $10^4$ and 3.4 × $10^4$ C, respectively. It was shown that the contribution of $^{90}$Sr from rivers flowing into the Black Sea averages about 16% of the total amount reaching the surface of the sea. During the years when no experiments were conducted the proportion of $^{90}$Sr entering the Black Sea from the rivers rose to 36%. This relatively large proportion is explained by the small dimensions of the Black Sea and the substantial area of the basins of the inflowing rivers. The large inflow of fission-fragment radionuclides from the rivers points to the impermissibility of disposing of radioactive wastes from the nuclear industry into the rivers flowing into the Black Sea, particularly since the overall capacity of the nuclear industry in Europe is continually growing. The real concentration of $^{90}$Sr in the surface layer of the Black Sea was shown to be lower than the concentration calculated on the assumption that the entire quantity of $^{90}$Sr is uniformly distributed in the surface mixing layer (as far as the thermocline). This indicates the penetration of artificial isotopes to a level lower than the surface mixing layer. The penetration of surface water to greater depths is compensated by the rise of water from below. Tests confirm this and indicate that the exchange proceeds faster than was earlier believed. Consequently, the Black Sea cannot be regarded as a suitable site for the deep disposal of radioactive wastes. (auth)

**45228** PROBLEMS OF DISPOSAL INTO THE SEA OF RESIDUAL WATER FROM THE LA HAGUE CENTRE. Ausset, R.; Cantel, J. (Centre de la Hague, Cherbourg, France). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/13, 14p. (In French). (CONF-660507-11). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

The establishment in western France of a large chemical plant for reprocessing fuel irradiated in natural uranium reactors operated by Electricité de France led, in the absence of a river with a large and regular rate of flow, to the need to study the possibilities of discharging into the sea the low-activity residual water resulting from decontamination of effluent. An area that seemed prima facie suitable for this purpose was the Pointe de La Hague, owing to the strong Raz Blanchard current, which was expected to bring about rapid dispersal of the radioisotopes in a large mass of sea water. Based on the estimates of the Centre's requirements, scale models were used to determine, and in situ experiments to confirm, a favorable location and a suitable timetable for carrying out disposal. The discharge of dye (rhodamine B), under the same conditions as would apply to disposal of the residual water, yielded data on the dispersal rate and threw light on the degree of accumulation in the sea that would result from repeated disposals. The residual water outlet comprises a short land section formed of a number of polyethylene tubes and of an underwater section 5500 m long. The technical problems of design and execution, particularly those associated with the altitude of the La Hague Centre (180 m above sea level) and with the strength of the ocean currents, were solved with the assistance of Government organizations. (auth)

**45229** REVIEW OF THE DISCHARGE OF LOW-ACTIVITY RADIOACTIVE EFFLUENT FROM WINDSCALE

WORKS INTO THE IRISH SEA. Howells, H. (United Kingdom Atomic Energy Authority, Sellafield, Eng.). Vienna, International Atomic Energy Agency, 1966, Preprint SM-72/50, 18p. (CONF-660507-29). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna.

The regular discharge of low-specific-activity, liquid effluent in relatively large volumes into coastal waters 3 km off the Cumberland coast has continued for nearly 15 years. A rigorous control has been exercised on the quantity of radioactivity discharged and detailed radioassays made on certain selected marine materials. These measurements established relationships between the rate of discharge of certain radionuclides and the subsequent uptake of the activity in the marine biota. Consideration is given to the manner in which this unique problem of radiological control was effected, the identification of the rate of activity discharge as a prime control factor, and the accumulation of radioactivity in edible seaweed as the limiting feature for this effluent discharge in this particular environment. The discharge of radioactivity at a rate of the order of some 10,000 C/yr was maintained over a period of nearly a decade and a half. Both the magnitude of the discharge and the extended period of operation make this pipeline discharge to sea unique. (auth)

**45230** INACTIVE PILOT PLANT STUDIES OF A PROCESS FOR VITRIFICATION OF HIGHLY RADIOACTIVE WASTE AT THE RESEARCH ESTABLISHMENT, RISOE. Brodersen, K.; Larsen, I. (Danish Atomic Energy Commission, Roskilde, Denmark). 14p. (CONF-660208-20). ORAU. Gmelin, AED-CONF-66-019-18.

From Symposium on Solidification and Long-Term Storage of Highly Radioactive Wastes, Richland, Wash.

At Risö, studies were carried out on vitrification of radioactive waste. The process investigated is a continuous direct vitrification without preliminary calcination. A process was chosen in which the heat is produced directly in the glass melt by sending a-c current through the glass, which acts as an electric resistance. In this way it is possible to use cheap ceramic materials for the melting chamber. The experiments were carried out with a borosilicate glass. Several experiments were run during the last few years, each with a duration of up to one week. The capacity of the plant is about 5 liter of feed per hour. (auth)

**45231** SURVEY OF THE STUDIES CONDUCTED IN FRANCE ON THE SOLIDIFICATION OF CONCENTRATED FISSION PRODUCT SOLUTIONS. Bonniaud, R. (Commissariat a l'Energie Atomique, Paris). 20p. (CONF-660208-21). ORAU. Gmelin, AED-CONF-66-019-27.

From Symposium on Solidification and Long-Term Storage of Highly Radioactive Wastes, Richland, Wash.

For Marcoule wastes, silicate glasses containing more than 1.500 C of fission product are produced. The leaching rate is about 1 to $3 \times 10^{-7}$ g-glass/cm$^2$/day and the volume reduction factor varies from 5 to 10. Technological studies are concentrated on the pot vitrification process by using an induction furnace and a pilot plant is in design at Marcoule. For wastes coming from uranium–molybdenum irradiated fuel, silicophosphate glasses are used and studies are being carried out on pot vitrification and continuous vitrification. Phosphate glasses are being studied to vitrify wastes rich in Al$^{3+}$ after removal of mercury. (auth)

**45232** REQUIREMENTS AND PROBLEMS OF HIGH ACTIVITY WASTE MANAGEMENT AT THE EUROCHEMIC REPROCESSING PLANT. Detilleux, E.; Lopez-Menchero, E.; Gehem, L.; Marcus, F. (Eurochemic Research Dept., Mol, Belg.). 31p. (CONF-660208-18). ORAU. Gmelin, AED-CONF-66-019-10.

From Symposium on Solidification and Long-Term Storage of Highly Radioactive Wastes, Richland, Wash.

The problems of waste management resulting from the large variation in the high-level waste expected at Eurochemic are reviewed. The future trends of fuel characteristics are evaluated as far as they can be foreseen from reactor projects now going on, or scheduled for the near future. Special attention is paid to the peculiar location of the Eurochemic site. The present storage plant is described and its role in a long-range policy is defined. The possibility of applying processes like vitrification and calcination, being developed in several countries, is under investigation. A feasibility study of the application of the Harwell Fingal process to Eurochemic conditions was carried out, while calcination processes and separation techniques for fission products are being assessed on the basis of the published data. (auth)

**45233** POT VITRIFICATION OF CONCENTRATED FISSION PRODUCT SOLUTIONS. Laude, Francis (Centre d'Etudes Nucleaires, Fontenay-aux-Roses, France). 16p. (CONF-660208-19). ORAU. Gmelin, AED-CONF-66-019-15.

From Symposium on Solidification and Long-Term Storage of Highly Radioactive Wastes, Richland, Wash.

Engineering-scale experiments with a vitrification pot at the Fontenay-aux-Roses Nuclear Center are described. The batch-type pot method consists of the following steps: simultaneous feeding and evaporation; calcination and melting; and transfer of the molten glass into a metallic crucible. Induction heating was used for all operations. Best results were obtained under the following conditions for inactive runs: vessel, 2-m high and 18.4-cm ID; charge, 90 liters of simulated fission products; feed flow rate, 15 l/hr; volume reduction, 5.4; molten glass flow rate, between 20 and 30 kg/hr; and vessel, 1-m high and 25-cm ID; charge, 200 liters; feed flow rate, 20 l/hr; volume reduction, 10; molten glass flow rate, 80 kg/hr. It is expected that 30 runs may be carried out without serious deterioration of the pot. For low-level active runs the activity loss was determined as a function of time and the ruthenium volatility was found to be about 20%. Testing of the ruthenium traps indicated that they were not completely satisfactory. The reheated and vitrified iron oxide granules were disposed successfully. (auth)

# GENERAL AND MISCELLANEOUS

**45234** (AECL-2460) SCIENCE AT AECL. (Atomic Energy of Canada Ltd., Chalk River (Ontario)). June 1966. 59p. Dep. mn. AECL $1.50.

A review of scientific activities at AECL is presented which gives information on progress in the various divisions such as physics, biology and health, chemistry and metallurgy, and reactor research. Research and development at Whiteshell are summarized. (J.R.D.)

**45235** (BNL-957) TWENTY-FOUR-HOUR DISPERSION OF RAGWEED POLLEN FROM KNOWN SOURCES. Raynor, Gilbert S.; Ogden, Eugene C. (Brookhaven National Lab., Upton, N. Y.). Dec. 1965. Contract AT(30-2)-Gen-16. 20p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The dispersion of ragweed pollen was measured by surrounding plants grown in circular plots by arrays of sampling devices during the pollination season. Daily volumetric samples were taken around 6 plots over a 2-yr period. Typical patterns of dispersion are described and the effects of source size, sampling height, distance, wind direction, speed, and turbulence and other meteorological variables, and land surface features on dispersion are discussed. Results are compared with published data on ragweed pollen and are related to dispersion theory. (C.H.)

**45236** (BNWL-113-17) PLUTONIUM ABSTRACTS. Volume 6, Number 5. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). June 30, 1966. Contract AT(45-1)-1830. 39p. Dep. mn. CFSTI $2.00 cy, $0.50 mn.

References (77) are given to reports and journals published from 1964 through part of 1966. The topics covered include biology and medicine, chemistry, health and safety, metallurgy, physics, and reactor technology as they pertain to plutonium. (P.C.H.)

**45237** (BNWL-113-18) PLUTONIUM ABSTRACTS, VOLUME 6, NUMBER 6. (Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.). July 30, 1966. Contract AT(45-1)-1830. 58p. Dep. mn. CFSTI $3.00 cy, $0.50 mn.

References (124) are given to reports and journals published from 1964 through part of 1966. The topics covered include biology and medicine, chemistry, health and safety, metallurgy, physics, and reactor technology as they pertain to plutonium. (P.C.H.)

**45238** (K-1675) AN APT POST PROCESSOR FOR POSITIONING MACHINES. Buchanan, M. G.; Easterday, R. J. (Oak Ridge Gaseous Diffusion Plant, Tenn.). Sept. 29, 1966. Contract W-7405-eng-26. 199p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

The APT Post Processor for positioning machines is a generalized post processor that produces command tapes for numerically controlled positioning machines. It provides a basic framework that allows easy implementation of new machines. (auth)

**45239** (NP-16267) RAPPORT ANNUEL, 1965. (Annual Report, 1965). (Commissariat a l'Energie Atomique, Paris (France)). 184p. Dep. mn.

The activities of the CEA during 1965 with respect to the production of base materials for the nuclear industry, scientific and technical research, nuclear reactors, artificial radioelements, military applications, relations of the CEA with industry, international relations, instruction, and finances are summarized. The general structure of the CEA with respect to research centers and the production centers is described. In the production of base materials the emphasis is on mining, concentration, and processing of natural U, production and recovery of enriched U, and production and supply of Pu. The technical and scientific research included studies of general physics, reactor physics, reactor chemistry, nuclear fuels, nuclear materials, physical chemistry, chemical and isotopic analysis, radiobiology, radiological protection, and radiogeology. Operations of the research, training, production, and power reactors are outlined. The industrial applications of radioisotopes are discussed. Examples are given of research of possible military applications of nuclear energy. (J.S.R.)

**45240** (SC-RR-66-376) DYNAMIC PENETRATION OF SELECTED PROJECTILES INTO PARTICULATE MEDIA. Thompson, L. J. (Sandia Corp., Albuquerque, N. Mex.). July 1966. Contract AT(29-1)-789. 206p. Dep. mn. CFSTI $6.00 cy, $1.25 mn.

A study of the process of projectile penetration into soil is described. The governing differential equations for the soil target medium are developed using the equations of motion and the continuity condition. Constitutive relationships are derived from Mohr-Coulomb theory for a rigid plastic material and from viscosity theory. The other necessary equations are generated from an experimental investigation of the penetration mechanism. (auth)

**45241** (SC-TM-65-135) MOTIVATION AND HUMAN ERROR. Rook, L. W. (Sandia Corp., Albuquerque, N. Mex.). Sept. 1965. Contract AT(29-1)-789. 10p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

The amount of improvement which can be obtained from error reduction programs in industry is a function of two factors—modifying people through motivational programs and modifying the work situation. Most of the emphasis in industry has been placed on modifying people. But the extent of improvement that can be obtained through motivational programs is limited and often transitory. Considerably greater and permanent improvement can be obtained through redesign of the work situation. Industry's emphasis on modifying people stems from a misunderstanding of the nature of human error; namely, the belief that human error is exclusively the result of a "lapse of attention" or a "lack of willingness" and that if people would just try harder, performance would be error-free. A more rational viewpoint, and one which is consistent with behavioral science and technology, is that human errors are the result of an interaction of a person with a situation. If this viewpoint is taken, it can be seen that the major responsibility for reducing errors lies with management rather than with the workers performing the tasks where the errors occur. A program of "designing for producibility" is recommended as the most effective way of reducing errors in industry. Such a program depends on management recognizing its responsibility for designing work environments that reduce the probability of human errors in productive work. (auth)

**45242** (TID-22978(Rev.)) COSTS OF LARGE FOSSIL FUEL FIRED POWER PLANTS. Newbold, H. L. R. (Jackson and Moreland, Boston, Mass.). Apr. 30, 1966. Revised July 15, 1966. Contract W-7405-eng-26, Subcontract 2602. 137p. (J and M-636A). Dep. mn. CFSTI $4.00 cy, $1.00 mn.

For Oak Ridge National Lab., Tenn.

A study was undertaken to provide a useful reference document for the AEC to establish current construction and operating costs of large fossil power plants with which nuclear plants must compete. It is intended for use in evaluating the cost trends for units expected to be installed within the next decade. Forty eight plant variations have been estimated to reflect effects of size, alternate fuels, type of construction, and first or second unit on a site. Cost factors for adjusting the estimates to a particular plant concept are included and discussed. Data are presented either in the form of curves or tabulations for easy reference. Among items considered are variations in construction costs with geographical regions, site conditions such as profile seismology, geology, and availability of water. Methods are provided for estimating lifetime plant capacity factor and levelized fixed charges. In designing a specific facility, capital costs are balanced against fuel, operation and maintenance costs. The optimized capital costs vary primarily with fuel cost and annual fixed charges on capital costs. In determining specific thermal cycles, annual fixed charges were taken at 12% and the fuel cost at 25 cents which is within the price competitive range indicated by a recent market analysis for large nuclear units in 1970. (auth)

**45243** (UCRL-14625(Rev.1)) MODELING THE CHROMOSOME. Hart, Roger G. (Lawrence Radiation Lab., Univ. of California, Livermore). Jan. 3, 1966. Contract W-7405-eng-48. 15p. Dep. mn. CFSTI $1.00 cy, $0.50 mn.

An attempt was made to model the chromosome with respect to its structure and its function insofar as both are known. To this end, a hypothetical scheme was developed for the replication of chromosomal DNA in agreement with the results of tracer studies and with known capabilities of DNA polymerases. In keeping with the replication scheme, each double-helical DNA molecule is postulated to be bent into a loop with its ends held together by the association of two linking proteins covalently bonded to the DNA. A third linking protein is bonded to the DNA molecule near its middle. The chromosome is envisioned as a long sequence of such DNA loops, with the two end-linking proteins of each loop associated with the middle-linking protein of the next loop in the series. Other aspects of the chromosome considered in this model are: control of messenger synthesis, which is attributed to gating proteins situated on the DNA at the sites where transcriptions begin, and to a coordinated histone-shifting mechanism that masks or unmasks the DNA templates; prophase contraction, which is explained as a supercoiling of the DNA loops, again caused by a systematic shift of histones; and crossing over, which results from misplacement of end-linking proteins during synapsis. Some genetic consequences of a loop-sequence chromosome model have already been considered by Stahl, whose work is cited. (auth)

**45244** (UR-49-687, pp 195-218) REIMBURSABLE WORK FOR OTHER FEDERAL AGENCIES. (Rochester Univ., N. Y. Atomic Energy Project).

Abstracts are presented on 8 publications during 1965 on miscellaneous research studies jointly sponsored by other federal agencies. Bibliographic information is included. (C.H.)

**45245** DEPARTMENT OF INDUSTRY AND CANADIAN NUCLEAR POWER. Rutledge, J. C. (Dept. of Industry, Ottawa). 11p. (CONF-660516-17). ORAU. Gmelin, AED-CONF-66-138-9.

From Annual Conference on Organic and Heavy Water Reactors, Winnipeg, Can.

The role of industry in Canadian nuclear power development is discussed. The functions of the department of industry, which are the promotion of research and development, the introduction of incentives to stimulate the process of technical innovation, and the use of modern technology, are considered in the light of three programs. These are "General Incentives for Research and Development," the "Program for the Advancement of Industrial Technology," and the "Program for Defence Export Development." (J.F.P.)

# CORPORATE AUTHOR INDEX

This index contains entries for this period for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt.," permitting a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

## A

**AEROJET-GENERAL NUCLEONICS, SAN RAMON, CALIF.**

- Latent heat of vaporization and vapor pressure of Na, 20: 43884 (AGN-8191(Vol.1))
- Oxidation of Hastelloy X, 20: 43838 (TID-23319)
- Radioisotope applications in hydrospace. III., 20: 43797 (AGN-8163 (Vol.3))
- Summary of RISE power conversion system selection, 20: 43799 (NP-16281)

**AEROSPACE TECHNOLOGY DIV., LIBRARY OF CONGRESS, WASHINGTON, D. C.**

- Bibliography on nuclear safety, 20: 43666 (AD-623557)

**AIR FORCE WEAPONS LAB., KIRTLAND AFB, N. MEX.**

- Computational model for geomagnetically trapped particle shells and kinematic parameters, 20: 44416 (AD-639436)

**AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT FIZIKI.**

- Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)
- Topology of magnetic field and diffusion of plasma in toroidal traps, 20: 44875 (MATT-Trans-37)

**AKADEMIYA NAUK UKRAINSKOI SSR, KHARKOV. FIZIKO-TEKHNICHESKII INSTITUT.**

- Drift instability of plasma discharge with oscillating electrons, 20: 44863 (NP-16310)

**AKTIEBOLAGET ATOMENERGI, STOCKHOLM (SWEDEN).**

- Neutron scattering and thermalization lectures, 20: 44587 (NP-16291)

**AMES LAB., IOWA STATE UNIV. OF SCIENCE AND TECH.**

- Frequency dependence of the magnetization of Ho, 20: 44992 (IS-T-108)
- Green's function method for antiferromagnetism, 20: 44029 (IS-T-99)
- Separation of Nb and Ta, 20: 43170 (IS-T-107)
- Spin-one particle in an external electromagnetic field, 20: 44480 (IS-T-95)

**APPLIED PHYSICS LAB., JOHNS HOPKINS UNIV., SILVER SPRING, MD.**

- Wave interactions between plasma and electrons in magnetic field, 20: 44853 (AD-630040)

**ARGONNE NATIONAL LAB., IDAHO FALLS, IDAHO.**

- BORAX-V neutronics, 20: 45202 (ANL-6964)
- Critical evaluation of fast fission cross sections, 20: 44622 (CONF-660303, pp 796-808)

**ARGONNE NATIONAL LAB., ILL.**

- Biophysics, 20: 42841 (ANL-7136, pp 266-89)
- Cellular Biochemistry, 20: 42702 (ANL-7136, pp 243-55)
- Cellular effects, 20: 42834 (ANL-7136, pp 46-63)
- Cellular fine structure, 20: 42701 (ANL-7136, pp 205-30)
- Chemical binding effects on resonance line shapes of $^{238}$U in UO$_2$ lattice, 20: 45064 (CONF-660303, pp 134-45)
- Comparison of multilevel and single level effects for a fissionable isotope, 20: 44630 (CONF-660303, pp 997-1003)
- Computer program for automatic decomposition of spectra from charged-particle reactions, 20: 44656 (TID-23315)
- Cost study of processing of oxide, carbide, and metal fast-breeder-reactor fuels, 20: 43410 (ANL-7137)
- Crevice-galvanic corrosion of aluminum, 20: 43824 (ANL-6236)
- Cross section uncertainties and reactor safety, 20: 45068 (CONF-660303, pp 430-53)
- Developmental biology, 20: 42839 (ANL-7136, pp 154-61)
- Dosimetry, 20: 43668 (ANL-7136, pp 1-16)
- Effects of (n,$\gamma$n$'$) processes on fast neutron capture and non-elastic spectra, 20: 44614 (CONF-660303, pp 613-22)
- Environmental radiation studies, 20: 43512(R) (ANL-7136, pp 315-27)
- Enzymology, 20: 42737 (ANL-7136, pp 231-42)
- Epidemiological studies in human populations, 20: 42700 (ANL-7136, pp 162-3)
- Growth of plants in compensated gravitational, magnetic, and electrical fields, 20: 42703 (ANL-7136, pp 302-14)
- Improvements in consolidation and fabrication of V–20 wt.% Ti (TV-20), 20: 43846 (ANL-7127)
- Inelastic neutron scattering: a compendium, 20: 44613 (CONF-660303, pp 577-98)
- Isotope studies: techniques and applications, 20: 42738 (ANL-7136, pp 255-65)
- Laboratory animal medicine, 20: 42699 (ANL-7136, pp 94-108)
- Literature survey on properties of Te, its O and fluorine compounds, 20: 43164 (ANL-7142)
- Low flux determination of capture-to-fission ratio, 20: 45071 (CONF-660303, pp 1092-7)
- Mammalian genetics, 20: 42837 (ANL-7136, pp 124-40)
- Measurement of the $^{6}$Li(n,$\alpha$) and $^{10}$B(n,$\alpha$) cross sections by the shell transmission method, 20: 44617 (CONF-660303, pp 701-12)
- Mechanisms of carcinogenesis and neoplastic growth, 20: 42840 (ANL-7136, pp 164-90)
- Microbial genetics, 20: 42838 (ANL-7136, pp 140-54)
- New approach to neutron resonance spectroscopy, 20: 44631 (CONF-660303, pp 1064-72)
- Physiological effects, 20: 42835 (ANL-7136, pp 63-80)
- Plant radiobiology, 20: 42842 (ANL-7136, pp 290-301)
- Prog. rpt. on biological and medical research, annual, 1965, 20: 42832 (ANL-7136)
- Prog. rpt. on physics, 5/66, 20: 44601(R) (ANL-7218)
- Prog. rpt. on reactor development, 8/66, 20: 45106 (ANL-7249)
- Radiation protection, 20: 42997 (ANL-7136, pp 191-204)
- Sensitivity of fast reactor parameters to cross section uncertainties, 20: 45069 (CONF-660303, pp 809-20)
- Somatic effects, 20: 42833 (ANL-7136, pp 16-46)
- Theoretical biology, 20: 42698 (ANL-7136, pp 80-94)
- Toxicity and metabolism of radionuclides, 20: 42836, (ANL-7136, pp 109-23)

**ARIZONA UNIV., TUCSON.**

- Relationship between terrestrial factors and climate, 20: 43505 (COO-689-60, App.A-5)

**ARIZONA UNIV., TUCSON. GEOCHEMICAL SECTION.**

- Argon-40 in cogenetic feldspar-mica mineral assemblages, 20: 43503 (COO-689-60, App.A-3)
- Cenozoic argon ages on metamorphic rocks from the Basin and Range Province, 20: 43501 (COO-689-60, App. A-1)
- Excess radiogenic Ar in minerals of the Amelia, Virginia pegmatites, 20: 43504 (COO-689-60, App.A-4)
- Gamma-ray spectrometer studies of hydrothermally-altered rocks, 20: 43507 (COO-689-60, App.A-7)
- Isotopic studies in the Roskruge Mountains, Pima County, Arizona, 20: 43502 (COO-689-60, App.A-2)
- Prog. rpt. on correlation and chronology of ore deposits and volcanic

rocks, annual, 6/65-7/66, 20: 43500 (COO-689-60)
Radioactive dating of Quaternary tephra, 20: 43506 (COO-689-60, App.A-6)
**ARMED FORCES RADIOBIOLOGY RESEARCH INST., BETHESDA, MD.**
Estimating fractional dose recovery effects, 20: 42829 (AD-635167)
**ARMY NUCLEAR DEFENSE LAB., EDGEWOOD ARSENAL, MD.**
Electron-spin-resonance in fast-neutron-irradiated phosphorus-doped silicon, 20: 43986 (AD-637937)
**ATOMIC BOMB CASUALTY COMMISSION, HIROSHIMA (JAPAN).**
Bibliography of published papers of Atomic Bomb Casualty Commission, 20: 42696 (ABCC-0-65)
Mortality, 1950-64, and disease and survivorship, 1958-64, 20: 42697 (ABCC-18-65)
Prog. rpt., annual, 7/58-6/59, 20: 42827 (ABCC-58-59)
Prog. rpt., annual, 7/59-7/60, 20: 42828 (ABCC-59-60)
**ATOMIC ENERGY BOARD, PELINDABA, PRETORIA (SOUTH AFRICA).**
Bibliography on nuclear techniques in forensic science, 20: 43082 (PEL-116)
**ATOMIC ENERGY COMMISSION, WASHINGTON, D. C.**
Adequacy of fast and intermediate cross section data from measurement of neutron spectra in bulk media, 20: 44580 (CONF-660303, pp 782-95)
Analytical descriptions of the sub-cadmium cross section of $^{233}$U, $^{235}$U, $^{239}$Pu, and $^{241}$Pu, 20: 44629 (CONF-660303, pp 985-96)
Boron cross sections as a source of discrepancy for capture cross sections in the kev region, 20: 44611 (CONF-660303, pp 486-501)
Capabilities and limitations of time-of-flight neutron spectroscopy between 100 eV and 100 kev, 20: 44610 (CONF-660303, pp 381-403)
Chemical binding effects on resonance line shapes of $^{238}$U in $UO_2$ lattice, 20: 45064 (CONF-660303, pp 134-45)
Comparison of multilevel and single level effects for a fissionable isotope, 20: 44630 (CONF-660303, pp 997-1003)
Compilation, evaluation, and reduction of neutron differential scattering data, 20: 44578 (CONF-660303, pp 335-53)
Comprehensive computer library of neutron activation cross sections, 20: 44608 (CONF-660303, pp 309-14)
Conference on neutron cross section technology, Washington, D. C., 3/66, 20: 44603 (CONF-660303)
Critical evaluation of fast fission cross sections, 20: 44622 (CONF-660303, pp 796-808)
Cross section calculations throughout the periodic table, 20: 44609 (CONF-660303, pp 315-27)
Cross section data compiling: present and future, 20: 44606 (CONF-660303, pp 226-34)
Cross section for the reaction $^{6}$Li(n,$\alpha$)T, 20: 44620 (CONF-660303, pp 763-5)
Cross section uncertainties and reactor safety, 20: 45068 (CONF-660303, pp 430-53)
Discrepancy between experimental and predicted cross sections for the $^{93}$Nb(n,2n)$^{92}$Nb reaction, 20: 44616 (CONF-660303, pp 682-9)
Effects of (n,γn′) processes on fast neutron capture and non-elastic spectra, 20: 44614 (CONF-660303, pp 613-22)
Effects of prepoison cross section of uncertainties on SNAP reactor performance, 20: 45193 (CONF-660303, pp 204-9)
Fission cross section of $^{241}$Pu from 20–200 ev as determined from a nuclear explosion, 20: 44625 (CONF-660303, pp 910-18)
Fission resonance cross section requirements for reactor design, 20: 45070 (CONF-660303, pp 823-39)
Future cross section needs of the nuclear power industry, 20: 45107 (CONF-660303, pp 1025-34)
Inelastic neutron scattering: a compendium, 20: 44613 (CONF-660303, pp 577-98)
Interpretation and evaluation of integral cross sections by reactivity measurements, 20: 44621 (CONF-660303, pp 773-81)
Interpretations of neutron cross sections of the fissionable materials for the resolved resonance region, 20: 44624 (CONF-660303, pp 873-94)
Low flux determination of capture-to-fission ratio, 20: 45071 (CONF-660303, pp 1092-7)
Measurement and analysis of cross sections of fissile nuclides, 20: 44623 (CONF-660303, pp 840-72)
Measurement of nonelastic cross section for Pb at 2.1 and 1.7 Mev, 20: 44618 (CONF-660303, pp 726-34)
Measurement of the $^{6}$Li(n,$\alpha$) and $^{10}$B(n,$\alpha$) cross sections by the shell transmission method, 20: 44617 (CONF-660303, pp 701-12)
Measurements and calculations of the Doppler effect on the reactions $^{238}$U(n,γ), $^{235}$U(n,f) and $^{239}$Pu(n,f) with neutrons in the energy range 0–25 kev, 20: 44627 (CONF-660303, pp 933-8)
Need for $^{238}$Pu and $^{244}$Cm cross section data, 20: 44628 (CONF-660303, pp 964-70)
Neutron capture cross section of the W isotopes from 0.01 to 10 ev, 20: 44605 (CONF-660303, pp 182-203)
Neutron cross-section evaluation by AIDA, 20: 44607 (CONF-660303, pp 270-86)
Neutron flux spectral determination by foil activation, 20: 44579 (CONF-660303, pp 532-53)
New approach to neutron resonance spectroscopy, 20: 44631 (CONF-660303, pp 1064-72)
Perturbation theory in burnup calculations, 20: 45067 (CONF-660303, pp 259-69)
Polyethylene double differential inelastic scattering cross sections for epithermal neutrons, 20: 44576 (CONF-660303, pp 122-33)
Problems associated with the analysis of total cross section data of radioactive samples, 20: 44604 (CONF-660303, pp 67-74)
Proposed recoil technique for neutron-proton differential cross section measurements in the 15–30 Mev range, 20: 44632 (CONF-660303, pp 1084-91)
Proton accelerators as sources of slow neutrons, 20: 44581 (CONF-660303, pp 1055-63)
Resonance structure above 100 kev, 20: 44612 (CONF-660303, pp 562-76)
Sensitivity of $D_2O$ moderated reactor parameters to thermal neutron scattering law, 20: 45066 (CONF-660303, pp 151-70)
Sensitivity of fast reactor parameters to cross section uncertainties, 20: 45069 (CONF-660303, pp 809-20)
Sensitivity of SNAP reactor calculations to uncertainties in Zr absorption cross section, 20: 45192 (CONF-660303, pp 88-90)
Sensitivity of thermal reactor parameters to scattering model, 20: 45065 (CONF-660303, pp 146-50)
Spin measurement of the 8.8 ev neutron resonance in $^{235}$U by means of the resonant scattering method, 20: 44619 (CONF-660303, pp 755-62)
Techniques for determining ETA for the thermally fissionable isotopes, 20: 44626 (CONF-660303, pp 919-32)
Use of integral measurements as supplementary data for determining neutron cross-sections, 20: 44577 (CONF-660303, pp 304-8)
14-Mev differential cross section of $^{93}$Nb, 20: 44615 (CONF-660303, pp 675-81)
**ATOMIC ENERGY ESTABLISHMENT, TROMBAY (INDIA).**
Apparatus for thermal conductivity determination of organic coolants used in nuclear reactors, 20: 43270 (AEET-245)
Development of U-Foam air filters, 20: 43570 (AEET-244)
Fuel cycles in PHWR and CANDU type reactors, 20: 45105 (AEET-252)
Incineration of low-level radioactive solid wastes and gas cleaning, 20: 45214 (AEET-243)
Physics studies of Prototype Power Reactor Project, 20: 45104 (AEET-239)
**ATOMIC ENERGY ESTABLISHMENT, WINFRITH (ENGLAND).**
METHUSELAH II FORTRAN program and nuclear data library for physics assessment of liquid-moderated reactors, 20: 45063 (AEEW-R-480)
**ATOMIC ENERGY OF CANADA LTD., CHALK RIVER (ONTARIO).**
Comparison of $^{240}$Pu and $^{238}$U in thermal fission reactors, 20: 45103 (AECL-2590)
Improved sheathed electric heater, 20: 43465 (AECL-2592)
Science at AECL, 20: 45234 (AECL-2460)
Wear and corrosion in water, 20: 43823 (AECL-2566)
**ATOMIC ENERGY OF CANADA, LTD., OTTAWA (ONTARIO). COMMERCIAL PRODUCTS DIV.**
Gamma irradiation in Canada. Vol. 4, 20: 43759 (AECL-2298(Vol.4))
**ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL (ENGLAND).**
Measurement of the variation of the ratio of fission to absorption in $^{235}$U between 1 and 100 ev incident neutron energy, 20: 44648 (NRDC-117)
X-ray fluorescence analysis, 20: 43058 (AERE-Bib-136(Pt.2))
**ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON (ENGLAND).**
Cross section for the reaction $^{6}$Li(n,$\alpha$)T, 20: 44620 (CONF-660303, pp 763-5)
Measurements and calculations of the Doppler effect on the reactions $^{238}$U(n,γ), $^{235}$U(n,f) and $^{239}$Pu(n,f) with neutrons in the energy range 0–25 kev, 20: 44627 (CONF-660303, pp 933-8)
**ATOMICS INTERNATIONAL, CANOGA PARK, CALIF.**
Adaptation of ORNL M-GAM code for use at AI, 20: 44586 (NAA-SR-Memo-12019)
Calculation of weight gain in gas-metal reactions, 20: 43898 (NAA-SR-Memo-11967)
Cold neutron effects in graphite diffusion measurements, 20: 44585 (NAA-SR-Memo-11866)
Compilation, evaluation, and reduction of neutron differential scattering data, 20: 44578 (CONF-660303, pp 335-53)
Compilation, evaluation, and production of nuclear data for reactor calculations, 20: 44583 (NAA-SR-11980(Vol.1))
Developmental irradiation test of SNAP-8 electrical components (HF-8), 20: 45194 (NAA-SR-11924)
DOLTL: computer code to calculate temperature drift for statically controlled SNAP 10A type reactors, 20: 45198 (NAA-SR-Memo-11977)
DRUTES: code to calculate design points of an unmanned, direct-radiating, thermoelectric system, 20: 45195 (NAA-SR-Memo-11819)
Effective group absorption cross-sections and resonance overlap, 20: 44582 (NAA-SR-11963)

Effects of prepoison cross section of uncertainties on SNAP reactor performance, 20: 45193 (CONF-660303, pp 204-9)
Fast neutron weighting factors for manrated SNAP reactor applications, 20: 43580 (NAA-SR-Memo-11901)
GRISM: code to generate multigroup constants from microscopic neutron cross section data, 20: 44584 (NAA-SR-11980(Vol.3))
Initial experience with large Na fires experiments (LF-1), 20: 45047 (NAA-SR-12041)
Irradiation behavior of unalloyed hypostoichiometric UC, 20: 45113 (NAA-SR-11440)
Least squares determination of isothermal rate constants for oxidation of metals, 20: 43172 (NAA-SR-Memo-11966)
Need for $^{238}$Pu and $^{244}$Cm cross section data, 20: 44628 (CONF-660303, pp 964-70)
Neutron cross-section evaluation by AIDA, 20: 44607 (CONF-660303, pp 270-86)
Neutron flux spectral determination by foil activation, 20: 44579 (CONF-660303, pp 532-53)
Nonspherical optical model, 2-PLUS, for fast neutron cross sections, 20: 44645 (NAA-SR-11706)
Optical-model analysis of some recent tungsten cross-section measurements, 20: 44646 (NAA-SR-11973)
Perturbation theory in burnup calculations, 20: 45067 (CONF-660303, pp 259-69)
Physical properties of steam and water above 1000 psia, 20: 43173 (NAA-SR-Memo-12006)
Sensitivity of SNAP reactor calculations to uncertainties in Zr absorption cross section, 20: 45192 (CONF-660303, pp 88-90)
UPSTART digital computer call program, 20: 45196 (NAA-SR-Memo-11894)
Weight scaling factors for SNAP reactor shields, 20: 45197 (NAA-SR-Memo-11971)

**AUSTRALIAN ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT, LUCAS HEIGHTS.**
Analytical description of growth of beryllium oxide during neutron irradiation, 20: 43985 (AAEC-TM-318)
Condensed tables for x-ray fluorescence analysis, 20: 43057 (AAEC-TM-321)
Fabrication of $^{233}$U/Al fuel plates for sub-critical assembly, 20: 43844 (AAEC-TM-315)

**AUTHORITY HEALTH AND SAFETY BRANCH, UNITED KINGDOM ATOMIC ENERGY AUTHORITY, HARWELL (ENGLAND).**
Physiologically safe working conditions for men wearing pressured suits, 20: 43571 (AHSB(RP)-R-70)

## B

**BABCOCK AND WILCOX CO., LYNCHBURG, VA. RESEARCH AND DEVELOPMENT DIV.**
Prog. rpt. on recycle U fabrication, final, 8/66, 20: 45094 (BAW-3460-2)

**BATTELLE MEMORIAL INST., COLUMBUS, OHIO.**
Chemical-equilibrium studies of organic-iodide formation under reactor-accident conditions, 20: 43166 (BMI-1781)
Flexibility of nozzles in spherical shells, 20: 43468 (TID-23344)
Prog. rpt. on fission-product deposition and its enhancement under reactor accident conditions, 4–6/66, 20: 45045 (BMI-X-10173)
Stresses at nozzles in spherical shells loaded with pressure, moment or thrust, 20: 43467 (TID-23343)

**BATTELLE-NORTHWEST, RICHLAND, WASH. PACIFIC NORTHWEST LAB.**
Ceramic fuel research studies, 20: 43811 (BNWL-269, pp 1.1-28)
Comparative costs of oxide and fuel elements, 20: 43849 (BNWL-273 (Vol.1 and App.))
Defect structures in neutron irradiated nickel, 20: 43990 (BNWL-SA-782)
Development of advanced fuel concepts, 20: 43848 (BNWL-269, pp 5.1-36)
Effect of oxidation, thermal cycling, and irradiation on SiC coated graphite, 20: 43825 (BNWL-242)
Effect on fuel element costs when certain reference values are varied, 20: 45095 (BNWL-273(Vol.3))
Effects of aging on dissimilar metal welded joints with multipass welding of Hastelloy X and Hastelloy W filler metal, 20: 43888 (BNWL-290(Pt.1))
Formation of transuranium isotopes in power reactors, 20: 43800 (BNWL-140(Rev.1))
Improved postirradiation stress-rupture properties of Hastelloy X-280, 20: 43887 (BNWL-231)
Inspection procedures for the application of safeguards to Yankee Nuclear Power Station, 20: 45108 (BNWL-119)
Ion-exchange separation of kilocurie quantities of high purity Pm, 20: 43411 (BNWL-SA-677)
Irradiation behavior of ceramic fuels, 20: 43988 (BNWL-269, pp 2.1-11)
Joint fuel development programs, 20: 43812 (BNWL-269, pp 4.1-9)
Plutonium Abstracts, Vol. 6, No. 5, 20: 45236 (BNWL-113-17)
Plutonium Abstracts, Vol. 6, No. 6, 7/66, 20: 45237 (BNWL-113-18)
Possible optimum use of thorium and uranium employing crossed-progeny fuel cycles, 20: 45096 (BNWL-289)
Prog. rpt. on ceramic research, 10–12/65, 20: 43810 (BNWL-269)
PRTR fuel element performance and fabrication, 20: 43989 (BNWL-269, pp 3.1-30)
Radiation dosimetry for radiation protection, 20: 43572 (BNWL-SA-816)
Reduction of reactor effluent water radionuclides by addition of sodium silicate to process water, 20: 45215 (BNWL-282)
Sensitivity of thermal reactor parameters to scattering model, 20: 45065 (CONF-660303, pp 146-50)
Trace elements and $^{137}$Cs in sea water by gamma-ray spectrometric techniques, 20: 43059 (BNWL-SA-674)

**BENDIX CORP., KANSAS CITY, MO.**
Radius generation in vibratory deburring, 20: 43847 (BDX-613-85)

**BETTIS ATOMIC POWER LAB., PITTSBURGH, PA.**
Fission resonance cross section requirements for reactor design, 20: 45070 (CONF-660303, pp 823-39)
SCAT-1 program to compute $T^{n}_{LL}$, matrices on Philco-2000, 20: 44663 (WAPD-TM-571)
Seven-point difference equations with arbitrary mesh spacing for neutron diffusion in 60° geometry by the integration technique, 20: 44590 (WAPD-T-1802)
Stresses at nozzles in spherical shells loaded with pressure, moment or thrust, 20: 43467 (TID-23343)

**BETTIS ATOMIC POWER LAB., WEST MIFFLIN, PA.**
Environmental radioactivity at Bettis Atomic Power Lab., 20: 43586 (PNRO-DEV-136)
PWR Core 2 seed 1 flux wire measurements, 20: 45125 (WAPD-PWR-TE-203)

**BOEING CO., SEATTLE, WASH.**
Prog. rpt. on macrolaminate particle composite material development, 6/65–7/66, 20: 43845 (AD-637573)

**BOLOGNA UNIV. (ITALY). ISTITUTO DI GENETICA.**
Induction of new genetic variability for quantitative traits by seed irradiation, 20: 42846 (IAEA-2466-13)

**BROOKHAVEN NATIONAL LAB., UPTON, N. Y.**
Bone marrow stem cell survival in nonuniformly exposed mammal, 20: 42844 (BNL-10385)
Brief survey of radiation effects applicable to geology problems, 20: 43987 (BNL-10569)
Channeling and related effects in the passage of charged particles through crystal lattices, 20: 44991 (BNL-10544)
Cross section data compiling: present and future, 20: 44606 (CONF-660303, pp 226-34)
Cross sections for transuranium element production, 20: 44602 (BNL-982)
Factors influencing variation in RBE in irradiation of maize seeds, 20: 42843 (BNL-10358)
Genetic tobacco tumors and problem of differentiation, 20: 42704 (BNL-967)
High-temperature liquid-metal technology review, Vol. 4, No. 2, 4/66, 20: 43808 (BNL-991)
High-temperature liquid-metal technology review, Vol. 4, No. 3, 6/66, 20: 43809 (BNL-50003)
Properties of hemopoietic stem cell, 20: 42705 (BNL-10405)
Tables giving internal conversion coefficients of gamma-radiation on the K- and L-shells, 20: 44664 (BNL-tr-65)
Twenty-four-hour dispersion of ragweed pollen from known sources, 20: 45235 (BNL-957)

**BRUSH BERYLLIUM CO., CLEVELAND, OHIO. RESEARCH AND DEVELOPMENT DEPT.**
Prog. rpt. on intermetallic compounds for very high-temperature applications, 4–6/61, 20: 43886 (BBC-111)

**BUREAU OF MINES, ALBANY, OREG. ALBANY METALLURGY RESEARCH CENTER.**
Electrical resistivity of fused hafnium carbide alloys at elevated temperature, 20: 43917 (USBM-RC-1113)

**BUREAU OF MINES, RENO, NEV. RENO METALLURGY RESEARCH CENTER.**
Density and molar volumes of binary fluoride mixtures, 20: 43165 (BM-RI-6836)

## C

**CALIFORNIA INST. OF TECH., PASADENA.**
Prog. rpt. on chemical dynamics and radiation chemistry, annual, 7/65-6/66, 20: 43288 (CALT-532-1)
Reaction dynamics in crossed molecular beams, 20: 44109 (CALT-532-3)
Use of integral measurements as supplementary data for determining neutron cross-sections, 20: 44577 (CONF-660303, pp 304-8)

**CALIFORNIA UNIV., BERKELEY. DONNER LAB.**
A technique for starvation of E. coli of thymine, 20: 42716 (UCRL-16246, pp 164-7)

Classification and evolution of patterns of erythropoiesis in polycythemia vera, 20: 43015 (UCRL-16246, pp 1-18)
Curve relating dose in time to pituitary histologic change following irradiation, 20: 43016 (UCRL-16246, pp 58-65)
Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)
Effects of simulated altitude on iodine metabolism. I., 20: 42745 (UCRL-16246, pp 126-37)
Microelectrophoretic and enzymatic studies concerning carbohydrate at surface of rat erythrocytes, 20: 42714 (UCRL-16246, pp 119-25)
Particle-size distribution of low-density plasma lipoproteins, 20: 42717 (UCRL-16246, pp 176-85)
Prog. rpt. on biology and medicine, semiannual, 1965, 20: 42711 (UCRL-16246)
Radiosensitivity of vestibular apparatus of rabbit, 20: 42858 (UCRL-16246, pp 74-83)
Responsiveness of hematopoietic tissue to erythropoietin, 20: 42713 (UCRL-16246, pp 107-18)
Single-strand breaks in duplex DNA of coliphage T7, 20: 42715 (UCRL-16246, pp 145-55)
Technique of patient alignment for pituitary irradiation, 20: 43017 (UCRL-16246, pp 66-73)
Ultracentrifuge rotor temperature and speed measurement by radio telemetry, 20: 43637 (UCRL-16246, pp 168-75)
Virus particles associated with immune responses in Ehrlich ascites tumor cells, 20: 42712 (UCRL-16246, pp 51-7)
Whole-body counting of $^{47}$Ca and $^{85}$Sr, 20: 42744 (UCRL-16246, pp 19-35)

**CALIFORNIA UNIV., BERKELEY. DONNER PAVILION.**
Classification and evolution of patterns of erythropoiesis in polycythemia vera, 20: 43015 (UCRL-16246, pp 1-18)
Curve relating dose in time to pituitary histologic change following irradiation, 20: 43016 (UCRL-16246, pp 58-65)
Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)
Effects of simulated altitude on iodine metabolism. I., 20: 42745 (UCRL-16246, pp 126-37)
Microelectrophoretic and enzymatic studies concerning carbohydrate at surface of rat erythrocytes, 20: 42714 (UCRL-16246, pp 119-25)
Particle-size distribution of low-density plasma lipoproteins, 20: 42717 (UCRL-16246, pp 176-85)
Prog. rpt. on biology and medicine, semiannual, 1965, 20: 42711 (UCRL-16246)
Radiosensitivity of vestibular apparatus of rabbit, 20: 42858 (UCRL-16246, pp 74-83)
Responsiveness of hematopoietic tissue to erythropoietin, 20: 42713 (UCRL-16246, pp 107-18)
Single-strand breaks in duplex DNA of coliphage T7, 20: 42715 (UCRL-16246, pp 145-55)
Technique for starvation of E. coli of thymine, 20: 42716 (UCRL-16246, pp 164-7)
Technique of patient alignment for pituitary irradiation, 20: 43017 (UCRL-16246, pp 66-73)
Ultracentrifuge rotor temperature and speed measurement by radio telemetry, 20: 43637 (UCRL-16246, pp 168-75)
Virus particles associated with immune responses in Ehrlich ascites tumor cells, 20: 42712 (UCRL-16246, pp 51-7)
Whole-body counting of $^{47}$Ca and $^{85}$Sr, 20: 42744 (UCRL-16246, pp 19-35)

**CALIFORNIA UNIV., BERKELEY. INST. OF MARINE RESOURCES.**
Prog. rpt. on radiation of heme proteins, 10/65-9/66, 20: 42799 (UCB-34P95-1)

**CALIFORNIA UNIV., SAN FRANCISCO. LAB. OF RADIOBIOLOGY.**
Blood formation and blood cell depletion and recovery after irradiation, 20: 42845 (CONF-660543-1)

**CANADIAN NUCLEAR ASSOCIATION, TORONTO (ONTARIO).**
Canada and nuclear power, 1966, 20: 45102 (66-CNA-320)
Status rpt. on Karachi Nuclear Power Project, 20: 45101 (66-CNA-305)

**CARNEGIE INST. OF TECH., PITTSBURGH, PA. DEPT. OF CHEMISTRY.**
Prog. rpt. on nuclear chemistry and geochemistry, annual, 1965–66, 20: 43550 (NYO-844-67)

**CENTENARY COLL., SHREVEPORT, LA. DEPT. OF BIOLOGY.**
Prog. rpt. on X-autosomal translocations of Drosophila melanogaster, final, 1966, 20: 42709 (TID-23233)

**CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE, BRUSSELS (BELGIUM).**
Reprocessing of irradiated fuel, 20: 43413 (EURAEC-1659)

**CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE, MOL (BELGIUM).**
Spin measurement of the 8.8 ev neutron resonance in $^{235}$U by means of the resonant scattering method, 20: 44619 (CONF-660303, pp 755-62)

**CERDIA, MASSY (FRANCE). LABORATOIRE DE BIOCHIMIE ET PHYSICO-CHIMIE DES CEREALES.**
Action of alpha and beta amylases on irradiated starch, 20: 42798 (NP-16224)

**CHANTIERS DE L'ATLANTIQUE PENHOET-LOIRE, PARIS (FRANCE).**
Austenitization of PM 24 steel, 20: 43891 (EURAEC-1686)

**CHASE BRASS AND COPPER CO., INC., WATERBURY, CONN.**
Fabrication of Zy-4 clad Zr-2.5 Nb pressure tubing, 20: 43862 (TID-23312)

**CITY COLL., NEW YORK.**
Proposed recoil technique for neutron-proton differential cross section measurements in the 15–30 Mev range, 20: 44632 (CONF-660303, 660303, pp 1084-91)

**COLUMBIA UNIV., NEW YORK.**
Capabilities and limitations of time-of-flight neutron spectroscopy between 100 eV and 100 kev, 20: 44610 (CONF-660303, pp 381-403)
Proposed recoil technique for neutron-proton differential cross section measurements in the 15–30 Mev range, 20: 44632 (CONF-660303, pp 1084-91)

**COMMISSARIAT A L'ENERGIE ATOMIQUE, FONTENAY-AUX-ROSES (FRANCE). CENTRE D'ETUDES NUCLEAIRES.**
Simplified method for the determination of $^{90}$Sr in large amounts of bone ash, 20: 43061 (CEA-R-2998)
Sintering of (U,Pu)O$_2$ pellets, 20: 43865 (EURFNR-96F)

**COMMISSARIAT A L'ENERGIE ATOMIQUE, GRENOBLE (FRANCE). CENTRE D'ETUDES NUCLEAIRES.**
Applications of neutron activation analysis in plant biology and agronomy, 20: 43060 (CEA-R-2967)

**COMMISSARIAT A L'ENERGIE ATOMIQUE, PARIS (FRANCE).**
Prog. rpt., annual, 1965, 20: 45239 (NP-16267)

**COMMISSARIAT A L'ENERGIE ATOMIQUE, SACLAY (FRANCE). CENTRE D'ETUDES NUCLEAIRES.**
Cryogenic equipment, 20: 44501 (CEA-R-3008)

**CONNECTICUT YANKEE ATOMIC POWER CO., HADDAM.**
Connecticut Yankee set point study, 20: 45115 (NYO-3250-7)

**CONVAIR, FORT WORTH, TEX.**
Discrepancy between experimental and predicted cross sections for the $^{93}$Nb(n,2n)$^{92}$Nb reaction, 20: 44616 (CONF-660303, pp 682-9)
14-Mev differential cross section of $^{93}$Nb, 20: 44615 (CONF-660303, pp 675-81)

**CORNELL AERONAUTICAL LAB., INC., BUFFALO, N. Y.**
Estimates of nonequilibrium ionization phenomena in the inviscid Apollo plasma sheath, 20: 44861 (NASA-CR-596)

**CORNELL UNIV., ITHACA, N. Y. LAB. OF ATOMIC AND SOLID STATE PHYSICS.**
Zero-phonon line luminescence at color centers in alkali halides, 20: 44994 (NYO-3464-2)

**CORNELL UNIV., ITHACA, N. Y. MATERIALS SCIENCE CENTER.**
Aspects of helicon propagation in metals, 20: 44993 (NYO-2150-19)

# D

**DANISH ATOMIC ENERGY COMMISSION, RISOE. RESEARCH ESTABLISHMENT.**
Compatibility of SAP 930 with UO$_2$ and UC, 20: 43835 (RISO-91)
Coolant mixing in multirod fuel bundles, 20: 45051 (RISO-125)
Problems involved in supply of natural and enriched U to users during period 1970–1985, 20: 45118 (RISO-M-434)

**DIVISION OF BIOLOGY AND MEDICINE (AEC), WASHINGTON, D. C.**
Aeroradioactivity survey and areal geology of Denver area, Colorado (ARMS-I), 20: 43513 (CEX-59.4.26)

**DU PONT DE NEMOURS (E. I.) & CO., AIKEN, S. C. SAVANNAH RIVER LAB.**
Compact actuator system for reactor control, 20: 45190 (DP-670)
Containment methods for alpha-gamma radioactivity at Savannah River Laboratory caves, 20: 43466 (DP-MS-66-16)
Determination of axial flux and axial exposure distributions in HWCTR, 20: 45203 (DP-1045)
Dissolution of thorium oxide, 20: 43412 (DP-1044)
Electrolytic preparation of uranous nitrate, 20: 43168 (DP-1065)
Prog. rpt. on effect of Savannah River Plant on environmental radioactivity, semiannual, 1–6/66, 20: 43577 (DPST-66-30-2)
Sensitivity of D$_2$O moderated reactor parameters to thermal neutron scattering law, 20: 45066 (CONF-660303, pp 151-70)

**DUKE UNIV., DURHAM, N. C.**
Resonance structure above 100 kev, 20: 44612 (CONF-660303, pp 562-76)

# E

**EAGLE-PICHER CO., MIAMI, OKLA.**
Prog. rpt. on purification and crystallization of amorphous B powder, annual, 7/65-6/66, 20: 43090 (TID-23342)

**EDGERTON, GERMESHAUSEN AND GRIER, INC., LAS VEGAS, NEV.**
Radiation measurements in residential structures. I., 20: 43496 (CEX-59.7B(Pt.1))

**EDGERTON, GERMESHAUSEN AND GRIER, INC., SANTA BARBARA,**

**CALIF.**

Increased transistor reliability in nuclear environments, 20: 43754 (EGG-1183-2046)

Radiation induced electrical phenomena in organic dielectrics, 20: 43991 (EGG-1183-2096)

**EMORY UNIV., ATLANTA, GA.**

Prog. rpt. on recovery from x-radiation damage in Tradescantia paludosa, 12/65-12/66, 20: 42977 (ORO-2669-2)

**ENTE NAZIONALE PER L'ENERGIA ELETTRICA, ROME (ITALY).**

Prog. rpt. on Garigliano nuclear power plant, 10–12/65, 20: 45121 (TID-23320)

Prog. rpt. on Garigliano nuclear power plant, 1–3/66, 20: 45122(TID-23321)

**EUROPEAN ATOMIC ENERGY COMMUNITY.**

Prog. rpt. on chemical radioprotective agents, final, 4/64-12/65, 20: 42998 (EUR-2992.f)

Radiochemical determination of chlorides dissolved in water, 20: 43063 (EUR-2990.f)

Radiochemical determination of oxygen dissolved in water, 20: 43064 (EUR-2991.f)

**EUROPEAN ATOMIC ENERGY COMMUNITY, ISPRA (ITALY). JOINT NUCLEAR RESEARCH CENTER.**

PNC effects in radiative capture of polarized neutrons: case of $^2$H(n,γ) and $^{113}$Cd(n,γ), 20: 44633 (EUR-3053.e)

**EUROPEAN COMPANY FOR THE CHEMICAL PROCESSING OF IRRADIATED FUELS, MOL (BELGIUM).**

Integrated dose and neutron spectra resulting from a criticality incident, 20: 43421 (NP-16216)

Remotely operated pipetting device, 20: 43077 (NP-16214)

**EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA (SWITZERLAND).**

High-voltage performances of electrostatic separators, 20: 44045 (NP-tr-1419)

## F

**FIELD EMISSION CORP., MCMINNVILLE, OREG.**

Prog. rpt. on ultrafast moderate-energy pulse power system, 4/62–7/64, 20: 44850 (AD-628506)

**FLORIDA STATE UNIV., TALLAHASSEE. DEPT. OF PSYCHOLOGY.**

Prog. rpt. on use of ionizing radiation as stimuli, 6/65-5/66, 20: 42852 (ORO-2903-28)

**FRANKFORD ARSENAL, PHILADELPHIA, PA.**

Heat treatment and mechanical properties of a U-2% Mo-2% Zr-2% Nb-0.5% Ti alloy, 20: 43883 (AD-637777)

## G

**GENERAL DYNAMICS CORP., SAN DIEGO, CALIF. GENERAL ATOMIC DIV.**

Adequacy of fast and intermediate cross section data from measurement of neutron spectra in bulk media, 20: 44580 (CONF-660303, pp 782-95)

Neutron capture cross section of the W isotopes from 0.01 to 10 ev, 20: 44605 (CONF-660303, pp 182-203)

**GENERAL DYNAMICS/FORT WORTH, TEX.**

Prog. rpt. on effects of various combinations of nuclear radiation, vacuum, and cryotemperatures on engineering materials, 5/64–5/66, 20: 43994 (FZK-290)

**GENERAL ELECTRIC CO., CINCINNATI, OHIO. NUCLEAR MATERIALS AND PROPULSION OPERATION.**

Program AVOID, NMP-838: FORTRAN IV program for evaluating equivalent diffusion coefficient and loss cross section of an annular void in cylindrical reactors, 20: 45072(GEMP-424)

**GENERAL ELECTRIC CO., CINCINNATI, OHIO. SPACE POWER AND PROPULSION SECTION.**

Prog. rpt. on advanced refractory alloy corrosion loop program, 1–4/66, 20: 43830 (NASA-CR-72029)

Prog. rpt. on advanced refractory alloy corrosion loop program, 4/15–7/15/66, 20: 43831 (NASA-CR-72057)

Purification, analysis and handling of Na and K, 20: 43083 (R-66SD3012)

**GENERAL ELECTRIC CO., PHILADELPHIA, PA. MISSILE AND SPACE DIV.**

Prog. rpt. on extra thermal ionization and MHD flows, final, 10/15/65, 20: 44402 (AD-628065)

**GENERAL ELECTRIC CO., PLEASANTON, CALIF. VALLECITOS ATOMIC LAB.**

Sintering studies and phase characterization in the system $Eu_2O_3$–$UO_2$, 20: 43853 (GEAP-5008)

Sodium mass transfer. XIV., 20: 43826 (GEAP-4830)

**GENERAL ELECTRIC CO., RICHLAND, WASH. HANFORD ATOMIC PRODUCTS OPERATION.**

Ammonium diuranate filterability, 20: 43428 (RL-SEP-924)

Data processing applications to a large, dual-purpose nuclear reactor, 20: 45191 (RL-GEN-1058)

Failure of coextruded Zircaloy-2 clad uranium fuel elements during static autoclave testing, 20: 43828 (HW-66911)

Multi-column ion exchange purification-concentration process for Am, 20: 43183 (RL-SEP-729(Rev.))

Nuclear safety in plutonium metallurgy, 20: 43578 (HW-59541)

Plutonium: steam oxidation and oxide dissolution, 20: 43854 (HW-66431)

Summary of $^{233}$U studies in Pu chemistry laboratory, 20: 43427 (RL-SEP-712)

**GENERAL ELECTRIC CO., SAN JOSE, CALIF. ADVANCED PRODUCTS OPERATION.**

EVESR Mark III superheat fuel bundle design, 20: 45110 (GEAP-4793)

**GENERAL ELECTRIC CO., SAN JOSE, CALIF. ATOMIC POWER EQUIPMENT DEPT.**

Future cross section needs of the nuclear power industry, 20: 45107 (CONF-660303, pp 1025-34)

**GENERAL TELEPHONE AND ELECTRONICS LABS. INC., BAYSIDE, N. Y.**

Niobium coating development for oxidation protection, 20: 43827 (GTR-19)

Tin–aluminum coatings for the elevated temperature oxidation protection of columbium and columbium-base alloys, 20: 43836 (TID-17070)

**GEOLOGICAL SURVEY, WASHINGTON, D. C.**

Aeroradioactivity survey and areal geology of Denver area, Colorado (ARMS-I), 20: 43513 (CEX-59.4.26)

**GEORGIA INST. OF TECH., ATLANTA.**

Conference on the utilization of research reactors, Georgia Institute of Technology, Atlanta, Georgia, 11/63, 20: 45206 (ORO-3191-1)

**GHENT RIJKSUNIVERSITEIT (BELGIUM).**

Stainless steel cladding of heavy gage steels, 20: 43852 (EURAEC-1685)

**GOODYEAR ATOMIC CORP., PORTSMOUTH, OHIO.**

Shipper-receiver differences involving U compounds above five percent $^{235}$U, 20: 43065 (GAT-T-1403)

**GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOI ENERGII SSSR.**

Basic features of the global $^{90}$Sr distribution on surface of world's oceans (1960–1961), 20: 43516 (AEC-tr-6798, Paper 1)

Evaluation of total quantity of $^{90}$Sr in World Ocean, 20: 43517 (AEC-tr-6798, Paper 2)

USSR reports on fallout over the oceans, 20: 43515 (AEC-tr-6798)

**GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOI ENERGII SSSR, MOSCOW. INSTITUT TEORETICHESKOI I EKSPERIMENTAL'NOI FIZIKI.**

Certain peculiarities of Schrodinger equation solutions for potentials with Coulomb tails, 20: 44283 (NP-16280)

Remarks on investigation $\pi^-$-p interactions in heavy liquid bubble chambers, 20: 44177 (NP-16278)

## H

**HUGHES AIRCRAFT CO., FULLERTON, CALIF.**

Prog. rpt. on radiation effects on microelectronic circuits, 2–4/65, 20: 43753 (AD-636773)

Surface effects of radiation on microelectronic devices. II., 20: 43752 (AD-635583)

## I

**IDAHO NUCLEAR CORP., IDAHO FALLS.**

Fission cross section of $^{241}$Pu from 0.01 ev to 0.5 ev, 20: 44635 (IN-1012)

**IIT RESEARCH INST., CHICAGO, ILL.**

Comprehensive computer library of neutron activation cross sections, 20: 44608 (CONF-660303, pp 309-14)

Cross section calculations throughout the periodic table, 20: 44609 (CONF-660303, pp 315-27)

Prog. rpt. on stress wave interaction in photoviscoelastic plates, 10/63-2/65, 20: 43495 (AD-628806)

Prog. rpt. on yield phenomena and fracture of hydrided Zr, 4–6/66, 20: 43892 (IITRI-578-P27-20)

**ILLINOIS UNIV., URBANA.**

Comparison of theory and experiment for shielding by structure against fallout, 20: 43568 (AD-636787)

Interpretations of neutron cross sections of the fissionable materials for the resolved resonance region, 20: 44624 (CONF-660303, pp 873-94)

Magnetic properties of dilute solutions of liquid $^3$He in $^4$He at low temperatures, 20: 44502 (COO-1198-382)

Prog. rpt. on fission product levels and metabolism in food producing animals, annual, 8/65-8/66, 20: 42739 (COO-1339-3)

Reaction dynamics in crossed molecular beams, 20: 44109 (CALT-532-3)

X-ray diffraction study of atomic ordering in two sigma phases, 20: 43890 (COO-1198-385)

**ILLINOIS UNIV., URBANA. DEPT. OF CHEMISTRY AND CHEMICAL ENGINEERING.**
Reaction of monoenergetic deuterium atoms with hydrogen molecules, 20: 43289 (CALT-532-2)
**ILLINOIS UNIV., URBANA. GASEOUS ELECTRONICS LAB.**
Density in N, O, and H afterglow plasmas, 20: 44852 (AD-629924)
Electronic recombination in He and Ar afterglow plasmas, 20: 44854 (AD-630074)
**INSTITUT ATOMNOI ENERGII, GOSUDARSTVENNYI KOMITET PO ISPOL'ZOVANIYU ATOMNOI ENERGII SSSR, MOSCOW.**
Cesium-137 content in human bone, 20: 42741 (NP-16265)
Dynamics of a non-cylindrical Z-pinch plasma sheath at a stage prior to cumulation, 20: 44872 (LA-tr-66-58)
General radiation sensitivity of organisms, 20: 42849 (NP-16258)
Influence of transverse currents on the equilibrium of toroidal plasma in the presence of conducting walls, 20: 44856 (IAE-1152)
Lifetime of individual charged particles in mirrored magnetic trap, 20: 44855 (IAE-1078)
Perturbation of magnetic surfaces, 20: 44028 (IAE-1150)
Plasma density spatial distribution measurements by means of multi-beam microwave probing, 20: 44857 (IAE-1153)
Seasonal variations of radiation sensitivity of rabbits, 20: 42848 (NP-16256)
Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)
Thermal insulation of plasma in Tokamak, 20: 44873 (MATT-Trans-35)
**INSTITUT FUER PLASMAPHYSIK, G.M.B.H. GARCHING (WEST GERMANY).**
Axisymmetric magnetohydrostatic equilibria, 20: 44858 (IPP-6/48)
Current density distribution in magnetohydrodynamic generator with segmented electrodes, 20: 44165 (IPP-3/41)
Empirical formula for the electron impact ionization cross section, 20: 44110 (IPP-1/50)
Equilibrium and stability of a plasma with surface currents, 20: 44859 (IPP-6/53)
Internal resistance of MHD generators, 20: 44164 (IPP-3/39)
Ionization potentials of atoms and ions from H to Ni ($Z = 28$), 20: 43169 (IPP-1/49)
**INSTITUT ZA VODOPRIVREDU "JAROSLAV CERNI," BELGRADE (YUGOSLAVIA).**
Application of radioactive tracers in study of sand movements in rivers, 12/65, 20: 43549 (NP-16200)
**INSTITUTE OF NUCLEAR PHYSICS, KRAKOW (POLAND).**
Transverse sum rule for electrons scattered inelastically with large momentum transfers from light nuclei, 20: 44636 (INP-479/PL)
**INSTITUTE OF NUCLEAR RESEARCH, WARSAW (POLAND).**
Decay scheme of $^{23}$Ne, 20: 44637 (INR-627/IA/PL)
Electronic pulse multiplier for identification of charged particles, 20: 43670 (INR-693/I/PL)
HELENA codes for material buckling determination in subcritical assemblies, 20: 45073 (INR-659/IXA/RP)
Influence of surface-active agents on the effect of decontamination, 20: 43579 (INR-725/XXII/C)
**INSTITUTE OF PLASMA PHYSICS, UNIV. OF NAGOYA (JAPAN).**
Report of 1965 Nagoya Meeting on space plasma physics, 20: 44069 (IPPJ-44(J))
**INSTITUTT FOR ATOMENERGI, HALDEN (NORWAY). OECD HALDEN REAKTOR PROSJEKT.**
Prog. rpt. on HBWR, 4–6/66, 20: 45111 (HPR-68)
**INTER-AMERICAN INST. OF AGRICULTURAL SCIENCES, TURRIALBA (COSTA RICA).**
Prog. rpt. on application of nuclear energy to agriculture, triennial, 7/63-6/66, 20: 42850 (NYO-2043-130)
**INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA (AUSTRIA).**
Bibliography on chemistry of transplutonium elements, 20: 43055 (STI-PUB-21/19)
Conference on application of food irradiation in developing countires. Vienna, 8/64, 20: 43760 (STI-DOC-10/54)
Environmental monitoring in emergency situations, 20: 43589 (STI-PUB-118)
Symposium on isotopes in weed research, Vienna, 10/65, 20: 42742 (STI-PUB-113)
**ISOCHEM INC., RICHLAND, WASH.**
Continuous uranium peroxide precipitation, 20: 43414 (ISO-207)
Recovery of $^{233}$U from irradiated thoria, 20: 43415 (ISO-SA-3(Rev.))
Remote maintenance in a large scale separations plant, 20: 43417 (ISO-SA-25)
Repair and modification techniques used on large scale separation facilities, 20: 43416 (ISO-SA-24)
**ISRAEL ATOMIC ENERGY COMMISSION, YAVNE. SOREQ NUCLEAR RESEARCH CENTER.**
High energy chemical reactions in gaseous phase, 20: 43291 (IA-1096)

J

**JACKSON AND MORELAND, BOSTON, MASS.**
Costs of large fossil fuel fired power plants, 20: 45242 (TID-22978 (Rev.))
**JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.**
Group constants for a fast reactor and sodium void effects, 20: 45075 (JAERI-1109)
JP-Hydro: code for study of thermal-hydro dynamics in natural-circulation, BWR, 20: 43479 (JAERI-1108)
KINAK: a code for one-dimensional, nuclear, thermal, and hydraulic calculation for BWR, 20: 45074(JAERI-1107)
Swelling of metallic uranium, 20: 43995 (JAERI-4037)
**JOHNS HOPKINS UNIV., BALTIMORE, MD.**
Ising chain statistics and magnetic phases in rare earth trichlorides, 20: 43176 (NP-16302)
Magnetic studies on erbium and terbium in gadolinium trichloride, 20: 43177 (NP-16303)
**JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF PHYSICS.**
Spectrum of Er(IV), 20: 43175 (NP-16301)
**JOINT INST. FOR NUCLEAR RESEARCH, DUBNA (USSR).**
Investigation of the decay scheme of $^{138*}$Pr, 20: 44643 (JINR-P-2819)
**JOINT INST. FOR NUCLEAR RESEARCH, DUBNA (USSR). LAB OF HIGH ENERGY.**
Radiative unit and critical energy in Xe, 20: 44642 (JINR-P-2808)
**JOINT INST. FOR NUCLEAR RESEARCH, DUBNA (USSR). LAB. OF NEUTRON PHYSICS.**
Differential cross section of $^{16}O(t,\alpha)^{15}N$ and $^{16}O(t,p)^{18}O$ reactions at energy range from 0.6 to 1.75 Mev, 20: 44641 (JINR-P-2796)
**JOINT INST. FOR NUCLEAR RESEARCH, DUBNA (USSR). LAB OF NUCLEAR PROBLEMS.**
New data on the conversion electron spectra of $^{153}$Dy, $^{155}$Dy, and $^{157}$Dy, 20: 44639 (JINR-P-2729)
**JOINT INST. FOR NUCLEAR RESEARCH, DUBNA (USSR). LAB OF NUCLEAR REACTIONS.**
Diffusion of nuclear reaction recoil products in different materials, 20: 43073 (JINR-P-2804)
**JOINT INST. FOR NUCLEAR RESEARCH, DUBNA (USSR). LAB OF THEORETICAL PHYSICS.**
Calculation of nucleon-phonon interaction effects in a simple nuclear model, 20: 44638 (JINR-E-2772)
Closed shells for $Z > 82$ and $N > 126$ in a diffuse potential well, 20: 44640 (JINR-P-2793)

K

**KANSAS UNIV., LAWRENCE. DEPT. OF CHEMISTRY.**
Paramagnetic relaxation characteristics of trapped electrons and H atoms in irradiated frozen solutions, 20: 43290 (COO-1528-7)
**KENTUCKY UNIV., LEXINGTON. DEPT. OF CHEMISTRY.**
Determination of antimony in materiels by neutron activation, 20: 43080 (ORO-2670-15)
**KERNFORSCHUNGSANLAGE, JUELICH (WEST GERMANY). INSTITUT FUER PLASMAPHYSIK.**
Breakdown of an electrodeless ring discharge and the development of the electron density and temperature in a spindle cusp, 20: 44860 (JUL-352-PP)
**KERNFORSCHUNGSZENTRUM, KARLSRUHE (WEST GERMANY). INSTITUT FUER ANGEWANDTE REAKTORPHYSIK.**
Neutronic values of Na-cooled fast reactors with SNEAK-2 assembly, 20: 45207 (EURFNR-76F)
**KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.**
Anticontamination clothing: no buttons, zippers, or taping required, 20: 43575 (CONF-660621-1)
Condensation heat transfer at an agitated, steam-water interface, 20: 43477 (CONF-661102-1)
Ductile-to-brittle transition of Nb–V alloys, 20: 43893 (KAPL-3119)
Ductile-to-brittle transition of Nb–V alloys, 20: 43894 (KAPL-3146)
**KNOXVILLE COLL., TENN.**
Prog. rpt. on $O_2$ consumption, $CO_2$ accumulation, and $N_2$ balance in mouse radiation chimeras, 1962–65, 20: 42854 (TID-23127)

L

**LABORATORI NAZIONALI DI FRASCATI, COMITATO NAZIONALE PER L'ENERGIA NUCLEARE (ITALY).**
A measurements of the branching ratio $\omega \to$ neutrals$/\omega \to \pi^+ + \pi^- + \pi^0$, 20: 44176 (LNF-66/31)
Photodisintegration of $^{6}$Li at high energy, 20: 44644 (LNF-66/32)
**LAWRENCE RADIATION LAB., UNIV. OF CALIFORNIA, BERKELEY.**
Applied thermodynamics in high-temperature refractories systems, 20: 43913 (UCRL-16256)
Calcium-37 and the mass 37 $T = \frac{3}{2}$ quartet, 20: 44659 (UCRL-16990)

Calorimetric investigation of superconductivity in alpha uranium, 20: 44504 (UCRL-17026)
Decomposition of chromium–tungsten solid solution, 20: 43914 (UCRL-16619)
Dynamic strain aging of a high-strength steel, 20: 43915 (UCRL-16761)
Measurement of electron spin relaxation times of ions in aqueous solution, 20: 43184 (UCRL-17064)
Multi-pion final states from $\pi^-p$ interactions at 3.2 and 4.2 Bev/c, 20: 44178 (UCRL-16881)
Radioactivity of cement raw materials, 20: 43514 (UCRL-16678)
Reaction channels in the capture of $K^-$-mesons by complex nuclei, 20: 44657 (UCRL-16602)
Strengthening mechanisms of ultra-high-strength austenitic steel, 20: 43916 (UCRL-16922)
Test of a microscopic description of nickel isotopes by inelastic proton scattering, 20: 44658 (UCRL-16984)

**LAWRENCE RADIATION LAB., UNIV. OF CALIFORNIA, LIVERMORE.**
Alice machine tape-recorder data acquisition system, 20: 43638 (UCRL-70018)
ASTRON alignment system, 20: 44866 (UCRL-70025)
ASTRON mechanical engineering design effort, 20: 44868 (UCRL-70027)
Bibliography on physical properties and phase diagrams of ten refractory oxides. Pt. I., 20: 43911 (UCRL-6262(Pt.1))
Determination of impurities in B by x-ray fluorescence, 20: 43091 (UCRL-14879)
Determining response of temperature sensors to rapid temperature rise, 20: 43635 (UCRL-12484(Rev.2))
Effect of pressure on temperature calibration of Mo/Mo-50 Re thermocouples, 20: 43636 (UCRL-14993)
Estimation of dosage to thyroids of children in U. S. from nuclear tests in Nevada, 1952–55, 20: 43590 (UCRL-14707)
Industrial applications of contained nuclear explosions, 20: 43463 (UCRL-14756)
Ion binding properties of human serum lipoproteins, 20: 42743 (UCRL-14631)
Mechanical design of the baseball coil and plasma-trapping chamber, 20: 44867 (UCRL-70026)
Modeling the chromosome, 20: 45243 (UCRL-14625(Rev.1))
Photoneutron measurements obtained with monochromatic photons, 20: 44660 (UCRL-70002)
Radiochemistry of Pu, 20: 43076 (NAS-NS-3058)
Remotized bolt cutter, 20: 43470 (UCRL-14743)
Stress intensity factors for hollow circumferentially notched round bars, 20: 43912 (UCRL-14859)

**LIEGE UNIV. (BELGIUM). LABORATOIRES DE RADIOBIOLOGIE.**
Prog. rpt. on chemical radioprotective agents, final, 4/64-12/65, 20: 42998 (EUR-2992.f)

**LOMA LINDA UNIV., LOS ANGELES, CALIF. INST. FOR CANCER AND BLOOD RESEARCH.**
Prog. rpt. on leukopoietic activity, annual, 3/65-4/66, 20: 42708 (TID-22931)

**LONDON UNIV. (ENGLAND). QUEEN MARY COLL.**
Motion of cylindrical plasma sheets in a magnetic field, 20: 44415 (AD-628320)

**LOS ALAMOS SCIENTIFIC LAB., UNIV. OF CALIFORNIA, N. MEX.**
Administration of secondary storage in nuclear codes, 20: 43804 (LA-3546)
Beta decay of cerium isotopes far to the neutron-rich side of stability, 20: 43419 (LA-DC-7869)
Characteristics and experimental program for an 800 Mev proton linear accelerator, 20: 44041 (LA-DC-8144)
Coated particle fuel elements for UHTREX, 20: 43855 (LA-DC-6954)
Delayed neutrons at fission threshold of $^{232}$Th, 20: 44672 (LA-tr-66-34)
Dependence of nucleo-synthesis abundance calculations on the mass law, 20: 44070 (LA-DC-7885)
Dissipation and critical velocities in superfluid helium, 20: 44503 (LA-DC-8165)
Fission fragments for fission of $^{235}$U induced by thermal neutrons and 5, 6, and 7 Mev neutrons, 20: 44673 (LA-tr-66-36)
Improvements in precise measurement of gamma activity, 20: 43074 (LA-DC-7831)
Interference reduction and sensitivity improvement in activation analysis, 20: 43075 (LA-DC-7931)
Irradiation capsule for molten Pu alloys, 20: 43996 (LA-DC-7772)
Liquid plutonium fuels, 20: 43814 (LA-DC-7581)
Movement of discrete particles through gastrointestinal tract, 20: 42740 (LA-DC-7764)
Nuclear magnetic relaxation measurements of $^{17}$O in enriched $H_2{}^{17}O$ and $D_2{}^{17}O$, 20: 43171 (LA-DC-7394(Rev.))
Processing of Pu by ion exchange. VIII., 20: 43418 (LA-3534)
Prog. rpt. on advanced reactor technology, 7/66, 20: 43829 (LA-3582)
Research activities of the A.E.C. aircraft in atmospheric testing, 20: 44417 (LA-DC-7837)
Stability of delta-phase Pu–Ga alloys, 20: 43895 (LA-DC-7934)
Thermal-acoustic oscillations induced by forced convection heating of dense H, 20: 43480 (LA-3543)
Thermal conductivity of ZTA graphite, 20: 43896 (LA-DC-8163)

**LOVELACE FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH, ALBUQUERQUE, N. MEX.**
Pathology of direct air-blast injury, 20: 42710 (TID-23348)

## M

**MALLINCKRODT CHEMICAL WORKS, WELDON SPRING, MO. URANIUM DIV.**
Laboratory investigation of recovery processes for pitchblende residues, 20: 43420 (MCW-1508)

**MASCHINENFABRIK AUGSBURG-NUERNBERG A. G., NUREMBERG (WEST GERMANY).**
Prog. rpt. on pulsating burnout, final, 3/66, 20: 43478 (EURAEC-1620)

**MASSACHUSETTS INST. OF TECH., CAMBRIDGE.**
Effect of W composition on mechanical properties of W–Ni–Fe heavy alloy, 20: 43885 (ASRL-TR-132-2)

**MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF NUCLEAR ENGINEERING.**
Measurement of nonelastic cross section for Pb at 2.1 and 1.7 Mev, 20: 44618 (CONF-660303, pp 726-34)
Spatial distributions of fast neutrons in lattices of slightly enriched U rods moderated by $D_2O$, 20: 45077 (MIT-2344-5)
Use of neutron absorbers for the experimental determination of lattice parameters in subcritical assemblies, 20: 45078 (MIT-2344-6)

**MECHANICAL TECHNOLOGY INC., LATHAM, N. Y.**
Flow phenomena in feeding region of an externally pressurized gas bearing, 20: 43469 (TID-23350)
Prog. rpt. on gas-bearing Brayton cycle turbocompressor, 3-6/66, 20: 43481 (NYO-3237-6)

**MEDICAL COLL. OF VIRGINIA, RICHMOND. DEPT. OF SURGERY.**
Prog. rpt. on effect of radiation on transplantation immunity, annual, 7/65-7/66, 20: 43013 (ORO-2459-1)

**MICHIGAN STATE UNIV., EAST LANSING. DIV. OF ENGINEERING RESEARCH.**
Prog. rpt. on growth and properties of metal and compound single crystals, final, 6/61–6/66, 20: 43910 (TID-23269)

**MIDWESTERN UNIVERSITIES RESEARCH ASSOCIATION, STOUGHTON, WIS.**
Analytical calculation of FFAG operating points and orbits, 20: 44042 (MURA-719)

**MINAS GERAIS UNIV., BELO HORIZONTE (BRAZIL). INSTITUTO DE PESQUISAS RADIOATIVAS.**
Radiostrontium in wet milk, tap-water, and rain water, 20: 42999 (NP-15934)

**MINISTRY OF AGRICULTURE, HAIFA (ISRAEL). SEA FISHERIES RESEARCH STATION.**
Prog. rpt. on physico-chemical-biological processes affecting dispersion of radionuclides. I and II, final, 12/61-12/64, 20: 43508 (NP-16179)

**MITRE CORP., BEDFORD, MASS.**
Electron collision frequency versus charged particle seeding, 20: 44851 (AD-628777)

**MOUND LAB., MIAMISBURG, OHIO.**
Liquid Pu: a review of its unusual properties, 20: 43889 (CONF-660606-39)

**MSA RESEARCH CORP., EVANS CITY, PA.**
Design properties of one heat of 2¼ Cr-1 Mo steel and 316 stainless steel in high temperature air, He and Na environments, 20: 43897 (MSAR-66-174)

**MUNICH UNIV. (WEST GERMANY). ERSTES PHYSIKALISCHES INSTITUT.**
Investigations into attachment properties of radioactive aerosols, 20: 43167 (BMwF-FBK-66-11)

## N

**NATIONAL ACADEMY OF SCIENCES–NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C. COMMITTEE ON NUCLEAR SCIENCE.**
Radiochemistry of Pu, 20: 43076 (NAS-NS-3058)

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, CLEVELAND, OHIO. LEWIS RESEARCH CENTER.**
Boron cross sections as a source of discrepancy for capture cross sections in the kev region, 20: 44611 (CONF-660303, pp 486-501)
Compatibility of Ta, Nb, and their alloys with H, 20: 43832 (NASA-TN-D-3546)
Neutron flux albedo for concrete, 20: 44988 (NASA-TM-X-1287)
Plasma probes with guard rings and thermocouples, 20: 44862 (NASA-TM-X-1294)
Structure and properties of tungsten-base powder metallurgy composites, 20: 43899 (NASA-TN-D-3610)

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD. GODDARD SPACE FLIGHT CENTER.**
Computational model for geomagnetically trapped particle shells and kinematic parameters, 20: 44416 (AD-639436)
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, HUNTSVILLE, ALA. GEORGE C. MARSHALL SPACE FLIGHT CENTER.**
Forming techniques for Be alloys, 20: 43856 (NASA-TM-X-53453(Vol.2))
Joining techniques for Be alloys, 20: 43859 (NASA-TM-X-53453(Vol.6))
Surface treatments for Be alloys, 20: 43857 (NASA-TM-X-53453(Vol.4))
Thermal treatments for Be alloys, 20: 43858 (NASA-TM-X-53453(Vol.5))
**NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.**
Bibliography on high temperature chemistry and physics of materials in condensed state, 20: 43903 (NP-16238)
Prog. rpt. on ceramic materials for reactor applications, 7/61–6/62, 20: 43900 (NBS-D-150)
Prog. rpt. on ceramic materials for reactor application, 7/62–6/63, 20: 43901 (NBS-D-154)
**NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE, CHILTON (ENGLAND). RUTHERFORD HIGH ENERGY LAB.**
Support insulators for high voltage apparatus in vacuum, 20: 44043 (RHEL-R-124)
**NATIONAL RADIATION LAB., CHRISTCHURCH (NEW ZEALAND).**
Prog. rpt., annual, 1965, 20: 43581 (NP-16245)
**NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO, CALIF.**
Colony-forming unit repopulation and split-dose radiosensitivity in endotoxin treated mice, 20: 42831 (AD-635600)
Effect of macrophages from irradiated donors on ability to transfer antibody formation, 20: 42830 (AD-635598)
Monte Carlo technique applied to the calculation of gamma-ray transport in compartmented structures, 20: 44987 (AD-637685)
Radioactivity release from radionuclide power sources. II., 20: 43592 (USNRDL-TR-1042)
**NAVAL RESEARCH LAB., WASHINGTON, D. C.**
Intensity measurements of some fundamental absorption bands of $H_2O$, $D_2O$, and $CS_2$, 20: 43178 (NRL-6394)
Prog. rpt. on irradiation effects on reactor structural materials, 8–10/65, 20: 43997 (NRL-Memo-1663)
**NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK, THE HAGUE. METAALINSTITUUT.**
Prog. rpt. on embrittlement in irradiated steel, 4–6/66, 20: 43993 (EURAEC-1691)
**NERATOOM, N. V., THE HAGUE (NETHERLANDS).**
Prog. rpt. on manufacturing pressure vessels, 10/65–6/66, 20: 43851 (EURAEC-1671)
Stainless steel cladding of heavy gage steels, 20: 43852 (EURAEC-1685)
**NEW MEXICO UNIV., ALBUQUERQUE.**
Thermal-acoustic oscillations induced by forced convection heating of dense H, 20: 43480 (LA-3543)
**NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA. DEPT. OF FOOD SCIENCE AND TECHNOLOGY.**
Prog. rpt. on biochemistry and physiology of irradiated fruits and vegetables, annual, 9/65-9/66, 20: 42851 (NYO-3274-9)
**NEW YORK STATE VETERINARY COLL., ITHACA, N. Y. DEPT. OF PHYSICAL BIOLOGY.**
Dietary intake of radionuclides, 20: 43573 (CONF-765-13)
**NEW YORK UNIV., N. Y. DEPT. OF PHYSICS.**
Prog. rpt. on calculations in atomic scattering and structure, 5/60–2/66, 20: 44108 (AD-630172)
**NORTH CAROLINA UNIV., CHAPEL HILL.**
Prog. rpt. on effects of ionizing radiation on plant species, 9/65-8/66, 20: 42853 (ORO-3299-1)
**NUCLEAR MATERIALS AND EQUIPMENT CORP., APOLLO, PA.**
Prog. rpt. on growth of single crystals of Pu, 4–6/66, 20: 43904 (NUMEC-3428-23)
**NUCLEAR METALS, INC., WEST CONCORD, MASS.**
Thoria dispersion in uranium, 20: 43902 (NMI-7018)
**NUKLEARNI INSTITUT "JOZEF STEFAN," LJUBLJANA (YUGOSLAVIA).**
Analysis of the low lying $0^+$ states in the middle weight nuclei, 20: 44647 (NIJS-R-484)

**O**

**OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.**
Adjoint Monte Carlo calculations for enriched U metal assemblies, 20: 45076 (K-DP-1637)
APT post processor for positioning machines, 20: 45238 (K-1675)
Gravimetric gas flow standard, 20: 43633 (K-1632(Pt-1))
**OAK RIDGE NATIONAL LAB., TENN.**
ADDENDUM: influence of cross-sectional shape on irradiation-induced stresses in graphite columns, 20: 44000 (ORNL-TM-1574)
Algorithm for a form of the problem $Av = \lambda Bv$, 20: 43805 (ORNL-3980)
Alpha M: computer program for determining radioisotopes by least-squares resolution of $\gamma$-ray spectra, 20: 43078 (ORNL-3975)
Characterization of volatile forms of iodine at high relative humidity by composite diffusion tubes, 20: 43582 (ORNL-3985)
Comparison of theoretical and experimental results from spherical shells with a single radially attached nozzle, 20: 43491 (ORNL-P-2472)
Core design and containment cost study for gas-cooled fast reactor studies, 20: 45117 (ORNL-TM-1194)
Corrosion of carbon and alloy steels in water and seawater, 20: 43834 (ORNL-TM-1612)
Costs of large fossil fuel fired power plants, 20: 45242 (TID-22978 (Rev.))
Dependence of Brueckner-Hartree-Fock calculations for light nuclei on details of the nucleon-nucleon interaction, 20: 44652 (ORNL-P-2468)
Design studies of 1000-Mw(e) molten-salt breeder reactors, 20: 45116 (ORNL-3996)
Differential cross sections for production of protons in reactions of 160-Mev protons on complex nuclei, 20: 44649 (ORNL-3887)
Differential scattering of neutrons from oxygen and intermediate states, 20: 44651 (ORNL-P-2434)
Dynamic corrosion studies for HFIR, 20: 43833 (ORNL-TM-1030)
Effect of alloying elements on the strength, stability, and corrosion and oxidation resistance of Nb, 20: 43905 (ORNL-3212)
Effect of curing stresses in epoxy resins, 20: 43906 (ORNL-P-2361)
Examination of praseodymium and europium hydroxide sols by electron microscopy and electron diffraction, 20: 43181 (ORNL-P-2439)
Feasibility of experiments using underground nuclear explosions, 20: 43460 (ORNL-P-2389)
Fluorination—vacuum-distillation system for regenerating fuel and fertile streams in MSBR, 20: 43422 (ORNL-3791)
Foam decontamination of air containing radioactive iodine, 20: 43585 (ORNL-TM-1589)
Formation of U, Zr, and Th oxide microspheres by hydrolysis of droplets, 20: 43182 (ORNL-TM-1508)
Heating in infinite cylinders by uniform gamma sources, 20: 45050 (ORNL-TM-1260)
Importance sampling devices for selecting track lengths and directions after scatter in 05R, 20: 44588 (ORNL-TM-1484)
In-place iodine filter testing, 20: 43584 (ORNL-P-2411)
Interface and transferring species in amine extraction of uranium, 20: 43424 (ORNL-P-2359)
Large-volume, highly uniform magnets, 20: 44030 (ORNL-P-2492)
Mass action and nonideality in extraction by amine sulfate, 20: 43423 (ORNL-P-2354)
Model and underground studies of the influence of stress, temperature, and radiation on flow and stability in rock salt mines, 20: 45217 (ORNL-P-2126)
Oak Ridge High Flux Isotope Reactor design and initial operation, 20: 45205 (ORNL-P-2491)
Optimization of reactor shutdown margin measurements in high gamma fluxes, 20: 45048 (ORNL-P-2311)
Philosophy of chemical processing equipment design and installation in Transuranium Processing Plant, 20: 43425 (ORNL-P-2406)
Photoelectric and optical properties of Pt, Au, and Pd foils and Al and Ag films, 20: 44995 (ORNL-TM-1392)
Plasma-density measurement in a hollow-cathode arc by arc reversal, 20: 44864 (ORNL-4010)
Possibility of irradiation damage affecting the rate-controlling mechanism for slip in body-centered cubic metals and solid solutions, 20: 43998 (ORNL-3993)
Present status and objectives of DCX-2 experiment, 20: 44865 (ORNL-4011)
Present status of neutron monitoring for personnel protection, 20: 43671 (ORNL-P-2467)
Prestressed concrete containments in nuclear power plants, 20: 45127 (ORNL-tr-1228)
Prog. rpt. on $O_2$ consumption, $CO_2$ accumulation, and $N_2$ balance in mouse radiation chimeras, 1962-65, 20: 42854 (TID-23127)
Proton accelerators as sources of slow neutrons, 20: 44581 (CONF-660303, pp 1055-63)
Proton-recoil neutron spectrometry with organic scintillators, 20: 43672 (ORNL-P-2471)
Remotely operated equipment for fabricating HFIR target elements, 20: 45204 (ORNL-P-2410)
Removal of radioactive methyl iodide from steam-air systems, 20: 45049 (ORNL-P-2431)
Sand filtration of foreign research reactor feed solutions, 20: 43426 (ORNL-TM-1650)
Search for the trineutron, 20: 44650 (ORNL-P-2412)
Secondary standardizations using computer techniques to normalize multiple $\gamma$-ray spectra for direct efficiency determinations, 20: 43380 (ORNL-P-2432)

Selected abstracts of non-U. S. literature on production and industrial uses of radioisotopes, 20: 43757 (ORNL-TM-1505(Pt.2))
Solutions to the problems of high-temperature irradiation embrittlement, 20: 43999 (ORNL-TM-1544)
Solving systems of polynomials in several indeterminates, 20: 43806 (ORNL-4008)
Standardization of $^{197}$Hg, 20: 43381 (ORNL-P-2433)
Status Report No. 5 on Clinch River study, 20: 45216 (ORNL-3721)
Stresses at nozzles in spherical shells loaded with pressure, moment or thrust, 20: 43467 (TID-23343)
Structural analysis of shipping casks, 20: 43492 (ORNL-TM-1312(Vol.2))
Survey of sensitivity limits for spectrographic determination of trace impurities in $U_3O_3$, 20: 43079 (ORNL-TM-1590)
Theoretical slip ratios in annular two-phase flow, 20: 43482 (ORNL-TM-1519)
Thermodynamic functions of nuclear materials: UC, $UC_2$, $UO_2$, $ThO_2$, and Un, 20: 43907 (ORNL-TM-1596)
Transition radiation and low-energy bremsstrahlung from silver and aluminum foils bombarded by grazing-incidence electrons, 20: 44111 (ORNL-TM-1571)
X-ray diffraction data on liquid water in temperature range 4 to 200 deg C, 20: 43180 (ORNL-3997)

**OESTERREICHISCHE STUDIENGESELLSCHAFT FUER ATOMENERGIE G.M.B.H., SEIBERSDORF.**
Fabrication methods and evaluation of U–Th–C fuel, 20: 43860 (SGAE-CH-35/1966)

**OFFICE OF SALINE WATER, WASHINGTON, D. C.**
Potentialities and possibilities of desalting for northern New Jersey and New York City, 20: 45186 (NP-16148)

**OFFICE OF THE ASSISTANT GENERAL MANAGER FOR REACTORS (AEC), WASHINGTON, D. C.**
Nuclear reactors built, being built, or planned in the United States as of 6/30/66, 20: 45052 (TID-8200(14th Rev.))

**OREGON STATE UNIV., CORVALLIS.**
Effects of irradiation on metabolism of glucose in rat, 20: 42856 (TID-23213)

**OREGON STATE UNIV., CORVALLIS. DEPT. OF OCEANOGRAPHY.**
Prog. rpt. on element and energy transfer in lower trophic levels in marine environment, 4/63-3/66, 20: 42731 (RLO-1751-2)

**OREGON UNIV., PORTLAND. DIV. OF EXPERIMENTAL MEDICINE.**
Biophysics section, 20: 43272 (RLO-581, pp 5-32)
Clinical studies on leukemia, 20: 43014 (RLO-581-10, pp 33-6)
Prog. rpt. on genetic alterations in human cells, 8/65-7/66, 20: 42707 (RLO-581-10)

**ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, PARIS (FRANCE).**
Prog. rpt. on high temperature reactor project, annual, 1965/1966, 20: 45114 (NP-16272)

# P

**PADUCAH GASEOUS DIFFUSION PLANT, KY.**
Accountability of $UF_6$ supplied to Paducah Gaseous Diffusion Plant by private firm, 20: 43062 (CONF-661011-1)

**PAVIA UNIV. (ITALY). ISTITUTO DI GENETICA.**
Induction of new genetic variability for quantitative traits by seed irradiation, 20: 42846 (IAEA-2466-13)

**PAVIA UNIV., RIETI (ITALY). CENTRO APPENNINICO DI GENETICA.**
Induction of new genetic variability for quantitative traits by seed irradiation, 20: 42846 (IAEA-2466-13)

**PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF ENGINEERING MECHANICS.**
Prog. rpt. on electron transmission study of oxide particle statistics in TD-nickel alloy, 5/65–4/66, 20: 43882 (AD-636487)

**PHILLIPS PETROLEUM CO. IDAHO FALLS, IDAHO., ATOMIC ENERGY DIV.**
Analytical descriptions of the sub-cadmium cross section of $^{233}$U, $^{235}$U, $^{239}$Pu and $^{241}$Pu, 20: 44629 (CONF-660303, pp 985-96)
Analytical development, 20: 43067 (IDO-14679, pp 6-46)
Chemical analysis, 20: 43069 (IDO-14679, pp 51-9)
Effects of metal-water reactions on the loss-of-coolant accident, 20: 45112 (IDO-17168)
Fission cross section of $^{241}$Pu from 20–200 ev as determined from a nuclear explosion, 20: 44625 (CONF-660303, pp 910-18)
Interpretation and evaluation of integral cross sections by reactivity measurements, 20: 44621 (CONF-660303, pp 773-81)
Measurement and analysis of cross sections of fissile nuclides, 20: 44623 (CONF-660303, pp 840-72)
Methods added to analytical manual in 1965, 20: 43071 (IDO-14679, pp 75-191)
Methods added to analytical radiochemical manual in 1965, 20: 43072 (IDO-14679, pp 193-229)
Problems associated with the analysis of total cross section data of radioactive samples, 20: 44604 (CONF-660303, pp 67-74)
Prog. rpt. on analytical chemistry, annual, 1965, 20: 43066 (IDO-14679)
Prog. rpt. on gamma-ray spectrometry of neutron-deficient isotopes, annual, 1965, 20: 44634 (IDO-17188)
Prog. rpt. on nuclear technology, 1–3/66, 20: 45046 (IDO-17192)
Spectroscopy, 20: 43068 (IDO-14679, pp 47-50)
Standards and quality control, 20: 43070 (IDO-14679, pp 60-9)
Techniques for determining ETA for the thermally fissionable isotopes, 20: 44626 (CONF-660303, pp 919-32)

**PLANNING RESEARCH CORP., LOS ANGELES, CALIF.**
Requirements for fire-resistant high-efficiency particulate air filters, 20: 43583 (ORNL-P-2387)

**PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN.**
Prog. rpt. on emissivity of materials, semiannual, 11/65–5/66, 20: 43816 (PWA-2877)

**PRATT AND WHITNEY AIRCRAFT, MIDDLETOWN, CONN. CONNECTICUT ADVANCED NUCLEAR ENGINEERING LAB.**
Nb-1 Zr alloy Li corrosion loop tests, 20: 43837 (TIM-823)
Survey of elevated temperature properties of niobium, 20: 43908 (PWAC-237)

**PRINCETON–PENNSYLVANIA ACCELERATOR, PRINCETON, N. J.**
Use of multisphere neutron detector for dosimetry of mixed radiation fields, 20: 43673 (PPAD-596-E)

**PRINCETON UNIV., N. J. PALMER PHYSICAL LAB.**
Application of multiparticle collision theory to the study of direct nuclear reactions, 20: 44654 (PUC-937-227)
Coupled channels and their application to resonances in the scattering of low-energy neutrons by $^{12}$C, 20: 44653 (PUC-937-219)

**PUBLIC HEALTH SERVICE, LAS VEGAS, NEV. SOUTHWESTERN RADIOLOGICAL HEALTH LAB.**
Bioenvironmental radiation research project, 20: 43574 (CONF-660538-1)
Radioiondine studies following the transient nuclear test (TNT) of Kiwi reactor, 20: 43576 (CONF-660621-7)

# R

**RAND CORP., SANTA MONICA, CALIF.**
Effects of nuclear war on the weather and climate, 20: 43510 (RM-4989-TAB)
Plague in the United States: assessment problem following thermonuclear war, 20: 43587 (RM-4968-TAB)
Survey of infectious disease problem as it relates to post-attack environment, 20: 43588 (RM-5090-TAB)
Survey of weapons and hazards which may face people of United States in wartime, 20: 43566 (AD-625251)

**RENSSELAER POLYTECHNIC INST., TROY, N. Y.**
Polyethylene double differential inelastic scattering cross sections for epithermal neutrons, 20: 44576 (CONF-660303, pp 122-33)
Prog. rpt. on gas-particle heat transfer coefficients in packed and fludized beds, annual, 1966, 20: 43483 (RPI-3639-1)

**RENSSELAER POLYTECHNIC INST., TROY, N. Y. DEPT. OF NUCLEAR ENGINEERING AND SCIENCE.**
Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)

**RESEARCH TRIANGLE INST., DURHAM, N. C.**
Radiological recovery requirements, structures, and operations research, 20: 43567 (AD-635820)

**ROCHESTER UNIV., N. Y. ATOMIC ENERGY PROJECT.**
Cancer research, 20: 42720 (UR-49-687, pp 177-94)
Chemical toxicity, 20: 42747 (UR-49-687, pp 148-76)
Molecular and cellular level studies, 20: 42719 (UR-49-687, pp 117-31)
Prog. rpt., annual, 1965, 20: 42718 (UR-49-687)
Radiation effects: general, 20: 42860 (UR-49-687, pp 1-65)
Radiological and health physics, and instrumentation, 20: 43591 (UR-49-687, pp 132-47)
Reimbursable work for other federal agencies, 20: 45244 (UR-49-687, pp 195-218)
Toxicity of radioelements, 20: 42746 (UR-49-687, pp 66-116)

**ROCHESTER UNIV., N. Y. DEPT. OF MECHANICAL AND AEROSPACE SCIENCES.**
Prog. rpt. on electron and ion density of air shock waves, final, 10/64–11/65, 20: 44403 (AD-628143)

**RUDOLF-VIRCHOW-KRANKENHAUS, BERLIN (WEST GERMANY). ABTEILUNG FUER STRAHLUNGSPHYSIK.**
Reduction of radiation burden of patient treated by high-energy radiation. I., 20: 43012 (BMWF-FBK-66-03)

# S

**SANDIA CORP., ALBUQUERQUE, N. MEX.**
Anomalous photocurrent generation in transistor structures, 20: 43755 (SC-DC-66-1821)
Dynamic penetration of selected projectiles into particulate media,

20: 45240 (SC-RR-66-376)
Effect of hydrostatic pressure (14 kbar) on the ultimate compressive strength of various sintered materials, 20: 43909 (SC-DC-66-1888)
Motivation and human error, 20: 45241 (SC-TM-65-135)
Multiple row charge blast-wave observations, Project DUGOUT, 20: 43461 (PNE-607F)
Research activities of the A.E.C. aircraft in atmospheric testing, 20: 44417 (LA-DC-7837)

**SCRIPPS CLINIC AND RESEARCH FOUNDATION, LA JOLLA, CALIF. DEPT. OF EXPERIMENTAL PATHOLOGY.**
Prog. rpt. on immune response and effect of radiation on this response, annual, 6/65-5/66, 20: 42855 (TID-23203)

**SIENA UNIV. (ITALY). ISTITUTO DI ZOOLOGIA E BIOLOGIA.**
Prog. rpt. on effects of radiation on reproductive organs of fruit flies, final, 12/62-12/65, 20: 42847 (NP-16176)

**SMITHSONIAN INSTITUTION, WASHINGTON, D. C.**
Prog. rpt. on botany, 2/65-2/66, 20: 42706 (NYO-2373-1)

**SOCIETA RICHERCHE IMPIANTI NUCLEARI, SALUGGIA (ITALY).**
Prog. rpt. on release of fission gases from irradiated $UO_2$, 1–3/66, 20: 43992 (EURAEC-1667)

**SOCIETE D'ENERGIE NUCLEAIRE FRANCO-BELGE DES ARDENNES, CHOOZ-LEZ-GIVET (FRANCE).**
Prog. rpt. on Ardennes Nuclear Power Plant, 1–3/66, 20: 45124 (TID-23339)
Prog. rpt. on reactor engineering, 10–12/65, 20: 45123 (TID-23338)

**SOCIETE D'ETUDES, DE RECHERCHES ET D'APPLICATIONS POUR L'INDUSTRIE, BRUSSELS (BELGIUM).**
Radiochemical determination of chlorides dissolved in water, 20: 43063 (EUR-2990.f)
Radiochemical determination of oxygen dissolved in water, 20: 43064 (EUR-2991.f)

**SOCIETE D'ETUDES ET D'EQUIPMENTS D'ENTREPRISES, PARIS (FRANCE).**
Prog. rpt. on design of prestressed concrete caisson for 1000 Mw(e) BWR, 1–3/66, 20: 45109 (EURAEC-1673)

**SOUDOMETAL, S. A., BRUSSELS (BELGIUM).**
Stainless steel cladding of heavy gage steels, 20: 43852 (EURAEC-1685)

**SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.**
Fabrication and installation of LACBWR reactor piping system, 20: 45119 (SWRI-1228-7-34)
Tensile and impact properties of LACBWR reactor vessel plate and control material, 20: 45120 (SWRI-1228-7-35)

**STAATLICHE ZENTRALE FUER STRAHLENSCHUTZ, BERLIN (EAST GERMANY).**
Tables of maximum energies of characteristic $\beta$-decay, 20: 44655 (SZS-4/66)

**STANFORD LINEAR ACCELERATOR CENTER, STANFORD UNIV., CALIF.**
Refinements in precision kilovolt pulse measurements, 20: 43634 (SLAC-PUB-199)

**STANFORD RESEARCH INST., MENLO PARK, CALIF.**
Near-surface spalling from a nuclear explosion in a salt dome, 20: 43462 (UCRL-13225)

**STANFORD UNIV., CALIF. DEPT. OF MECHANICAL ENGINEERING.**
Prog. rpt. on direct-energy conversion systems, 3–5/65. I., 20: 44163 (AD-628528)

**SUNDSTRAND AVIATION-ROCKFORD, ILL.**
Prog. rpt. on organic Rankine cycle technology, 2-6/66, 20: 43497 (SAN-651-1)

**SYLCOR DIV., SYLVANIA ELECTRIC PRODUCTS INC., BAYSIDE, N. Y.**
Pressure bonding of hollow thorium cores in aluminum cans, 20: 43861 (TID-12860)

## T

**TEMPLE UNIV., PHILADELPHIA, PA.**
Containment of liquid Zr and Nb carbides on graphite between 3500° and 4700°K, 20: 43174 (NASA-CR-608)

**TEMPLE UNIV., PHILADELPHIA, PA. RESEARCH INST.**
Prog. rpt. on high temperature inorganic chemistry, annual, 7/65-7/66, 20: 43179 (NYO-2082-6)

**TENNESSEE UNIV., KNOXVILLE.**
Algorithm for a form of the problem $Av = \lambda Bv$, 20: 43805 (ORNL-3980)
Comparison of theoretical and experimental results from spherical shells with a single radially attached nozzle, 20: 43491 (ORNL-P-2472)
Photoelectric and optical properties of Pt, Au, and Pd foils and Al and Ag films, 20: 44995 (ORNL-TM-1392)
Solving systems of polynomials in several indeterminates, 20: 43806 (ORNL-4008)

**TENNESSEE UNIV., KNOXVILLE. DEPT. OF CHEMISTRY.**
Radiation-induced cationic polymerization, 20: 43292 (ORO-2968-21)

**TEXAS AGRICULTURAL AND MECHANICAL UNIV., COLLEGE STATION. DEPT. OF OCEANOGRAPHY AND METEOROLOGY.**
Distribution of Cu, Mn and Zn in ocean using neutron activation analysis, 20: 43085 (TID-23295, Sect. 2)
Neutron activation analysis of Ru in sea water, 20: 43086 (TID-23295, Sect. 3)
Prog. rpt. on chemistry and analysis of trace metals in sea water, final, 2/61-1/66, 20: 43084 (TID-23295)
Rare earth distribution in waters of Gulf of Mexico, 20: 43087 (TID-23295, Sect. 4)
Zirconium analysis of sea water, 20: 43088 (TID-23295, Sect. 5)

**TEXAS NUCLEAR CORP., AUSTIN.**
Separation of isotopic interferences utilizing Ge(Li) gamma ray detectors, 20: 43081 (ORO-2980-13)

**THERMO ELECTRON ENGINEERING CORP., WALTHAM, MASS.**
Prog. rpt. on vacuum foil-type insulation for radioisotope power systems, 5–7/66, 20: 43798 (ALO-3634-2)

**TRW SYSTEMS, REDONDO BEACH, CALIF.**
Prog. rpt. on kinetic studies of heterogeneous water reactors, 1-3/66, 20: 43484 (STL-372-38)

## U

**UED EARTH SCIENCES DIV., TELEDYNE SYSTEMS CO., PASADENA, CALIF.**
Seismic velocity determination and distance measurements in salt dome, 20: 43551 (VUF-3015)

**UNION CARBIDE CORP., OAK RIDGE, TENN. Y-12 PLANT.**
Falling drop density analysis for relative concentrations of H and D in lithium deuteride, 20: 43089 (Y-1175(Del.))
Hot pressing techniques for beryllium oxide, 20: 43863 (Y-1290)
Machinability of some infrequently used materials, 20: 43864 (Y-1550)
Purification of concentrated lithium chloride solution, 20: 43092 (Y-1553)

**UNITED NUCLEAR CORP., ELMSFORD, N. Y.**
Neutron cross sections of N, O, Al, Si, Fe, D, and Be, 20: 44661 (UNC-5139)

**UNITED STATES–EURATOM FAST REACTOR EXCHANGE PROGRAM.**
Neutronic values of Na-cooled fast reactors with SNEAK-2 assembly, 20: 45207 (EURFNR-76F)
Sintering of $(U,Pu)O_2$ pellets, 20: 43865 (EURFNR-96F)

**UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.**
Austenitization of PM 24 steel, 20: 43891 (EURAEC-1686)
Prog. rpt. on design of prestressed concrete caisson for 1000 Mw(e) BWR, 1–3/66, 20: 45109 (EURAEC-1673)
Prog. rpt. on embrittlement in irradiated steel, 4–6/66, 20: 43993 (EURAEC-1691)
Prog. rpt. on fission-product deposition and its enhancement under reacto accident conditions, 4–6/66, 20: 45045 (BMI-X-10173)
Prog. rpt. on manufacturing pressure vessels, 10/65–6/66, 20: 43851 (EURAEC-1671)
Prog. rpt. on pulsating burnout, final, 3/66, 20: 43478 (EURAEC-1620)
Prog. rpt. on release of fission gases from irradiated $UO_2$, 1–3/66, 20: 43992 (EURAEC-1667)
Prog. rpt. on yield phenomena and fracture of hydrided Zr, 4–6/66, 20: 43892 (IITRI-578-P27-20)
Reprocessing of irradiated fuel, 20: 43413 (EURAEC-1659)
Stainless steel cladding of heavy gage steels, 20: 43852 (EURAEC-1685)

**UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.**
Effect of $Z = 28$ shell closure on proton total reaction cross sections, 20: 44662 (USC-136-111)

**UTAH UNIV., SALT LAKE CITY. DEPT. OF CERAMIC ENGINEERING.**
Prog. rpt. on recrystallization and sintering of oxides, 9/65–8/66, 20: 43813 (COO-1122-3)

**UTAH UNIV., SALT LAKE CITY. UPPER AIR RESEARCH LAB.**
Soft electron spectrometer for auroral research, 20: 43667 (AD-639694)

## V

**VANDERBILT UNIV., NASHVILLE, TENN.**
Transition radiation and low-energy bremsstrahlung from silver and aluminum foils bombarded by grazing-incidence electrons, 20: 44111 (ORNL-TM-1571)

## W

**WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL). DEPT. OF APPLIED MATHEMATICS.**
Prog. rpt. on equations of motion of viscous fluid, final, 8/25/65. I., 20: 44404 (AD-628179)

**WESTERN RESERVE UNIV., CLEVELAND, OHIO. SCHOOL OF MEDICINE.**

Prog. rpt. on physiological function and histological changes in thyroid irradiated with $^{131}$I, annual, 6/65-6/66, 20: 42857 (TID-23228)

**WESTINGHOUSE ELECTRIC CORP., LIMA, OHIO. AEROSPACE ELECTRICAL DIV.**

Prog. rpt. on magnetic and electrical materials capable of operating in 800 to 1600°F temperature range, 6–8/65, 20: 43815 (NASA-CR-54356)

**WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA. ASTRO-NUCLEAR LAB.**

GAM-TNS cross section library for the n + W reactions, 20: 44589 (WANL-TME-1472)

**WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA. ATOMIC POWER DIV.**

Chemical evaluation of Yankee Core I fuel cladding corrosion products, 20: 45126 (WCAP-6072)

Connecticut Yankee set point study, 20: 45115 (NYO-3250-7)

Irradiation of UO$_2$ and UC, at high specific power to high burnups, post irradiation examination of capsule 1, 20: 45097 (WCAP-2972)

Prog. rpt. on supercritical technology, 10–12/64, 20: 45098 (WCAP-3374-4)

**WICHITA STATE UNIV., KANS.**

Isotopic studies in the Roskruge Mountains, Pima County, Arizona, 20: 43502 (COO-689-60, App.A-2)

**WYOMING UNIV., LARAMIE.**

Nuclear magnetic relaxation measurements of $^{17}$O in enriched $H_2{}^{17}O$ and $D_2{}^{17}O$, 20: 43171 (LA-DC-7394(Rev.))

Z

**ZENTRALINSTITUT FUER KERNFORSCHUNG, ROSSENDORF BEI DRESDEN (EAST GERMANY).**

Precipitation of uranium dioxide from alkali chloride melts, 20: 43185 (ZFK-WF-25)

**ZENTRALSTELLE FUER ATOMKERNENERGIE-DOKUMENTATION, GMELIN-INSTITUT FUER ANORGANISCHE CHEMIE UND GRENZGEBIETE, FRANKFURT AM MAIN (WEST GERMANY).**

Bibliography on decontamination, 6/66, 20: 43569 (AED-C-13-04)

# PERSONAL AUTHOR INDEX

Each entry after an author's name is a shortened version of the title of the report or article, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt.," permitting a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

ä becomes ae
ö oe
ø oe
ü ue (except in transliterated Chinese names)

## A

**AAMODT, R. Lee,** High pressure $^3$He gas scintillation neutron detector, 20: 43733

**ABAGYAN, L. P.,** Cross-sections of neutron reactions accompanied by emission of charged particles, 20: 44671 (INDSWG-101, pp 164-223)

**ABAGYAN, L. P.,** Parameters of discrete resonance levels, 20: 44667 (INDSWG-101, pp 23-72a)

**ABASHIAN, A.,** Experimental investigation of CP violation in $K_{2}^{0}$ decays, 20: 44259

**ABASHIAN, A.,** Test of time-reversal invariance in $K_{L}^{0} \to \pi^- + \mu^+ + \nu$, 20: 44252

**ABBATTISTA, N.,** Dynamic behavior of tunnel diode monostable circuits, 20: 43649

**ABDEL WAHAB, M. F.,** Effect of gibberellic acid on phosphate availability in Vicia faba seedlings. II., 20: 42771

**ABE, Shigeki,** Application of photoactivation to determination of Ge in Ti, 20: 43102

**ABEE, H. H.,** Radioactivity in bottom sediments of the Clinch-Tennessee Rivers, 20: 45223

**ABELES, B.,** Enhancement of superconductivity in metal films, 20: 44552

**ABRAHAMS, John H. Jr.,** Soil and sediment analysis: for environmental radiation surveillance, 20: 42733

**ABRAHAMSSON, K.,** Clostridium botulinum, type E, in relation to irradiation treatment of fresh fish, 20: 43779

**ABRAMISHVILI, M. G.,** Influence of structural dislocations on mechanical properties of irradiated crystals, 20: 43304

**ABRAMS, R. J.,** Experimental investigation of CP violation in $K_{2}^{0}$ decays, 20: 44259

**ABRAMS, R. J.,** Test of time-reversal invariance in $K_{L}^{0} \to \pi^- + \mu^+ + \nu$, 20: 44252

**ABU-SITTA, Ali M.,** MHD flow in rectangular channel at high Hartmann number, 20: 44413

**ACETO, Henry,** Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)

**ACHE, Hans J.,** Mechanism of self-induced isotopic exchange of tritium with toluene, 20: 43268

**ACHENER, P. Y.,** Latent heat of vaporization and vapor pressure of Na, 20: 43884 (AGN-8191(Vol.1))

**ACKER, H. L.,** Study of the charge distribution in deformed nuclei by muonic hyperfine structure, 20: 44721

**ACKLEY, R. D.,** Removal of radioactive methyl iodide from steam–air systems, 20: 45049 (ORNL-P-2431)

**ACTON, Loren W.,** Resolution of x-ray sources at low galactic longitude, 20: 44091

**ADAM, A.,** Anomaly of small angle neutron scattering by $^{238}$U, 20: 44764

**ADAM, A. Warren,** Prog. rpt. on organic Rankine cycle technology, 2–6/66, 20: 43497 (SAN-651-1)

**ADAM, E.,** Problems of treating and testing fuel elements with regard to the power increase of the Rossendorf Experimental Reactor, 20: 45210

**ADAMS, G. E.,** Pulse radiolysis investigations of unimolecular elimination reactions in free radicals produced by OH addition to hydroxybenzenes, 20: 43332

**ADAMS, J. Barclay,** Effect of strong correlations on baryon-baryon weak interactions, 20: 44760

**ADAMS, R. E.,** Characterization of volatile forms of iodine at high relative humidity by composite diffusion tubes, 20: 43582 (ORNL-3985)

**ADAMS, R. E.,** Removal of radioactive methyl iodide from steam–air systems, 20: 45049 (ORNL-P-2431)

**ADEMOLLO, M.,** $SU(6)_W$ algebra at infinite momentum, its tensor charges, and electric dipoles, 20: 44358

**ADIN, A.,** Kinetics of the oxidation of Eu(II) with V(III) and Cr(III) in aqueous perchloric acid solutions, 20: 43228

**ADITYA, Prem K.,** Determination of mean multiple Coulomb scattering in nuclear emulsions, 20: 43690

**ADKINS, C. R.,** Chemical binding effects on resonance line shapes of $^{238}$U in $UO_2$ lattice, 20: 45064 (CONF-660303, pp 134-45)

**ADLER, D. B.,** Interpretations of neutron cross sections of the fissionable materials for the resolved resonance region, 20: 44624 (CONF-660303, pp 873-94)

**ADLER, F. T.,** Interpretations of neutron cross sections of the fissionable materials for the resolved resonance region, 20: 44624 (CONF-660303, pp 873-94)

**ADLOFF, J.,** Transition between rotational bands in $^{16}$O, 20: 44776

**ADLOFF, J. P.,** Influence of nature and energy of ion beam on gain of electron multiplier, 20: 43659

**ADLOFF, J. P.,** Szilard-Chalmers effects in solid Xe compounds, 20: 43373

**AGANOVIC, I.,** Complex singularities of Feynman diagrams, 20: 44343

**AGARWALA, R. P.,** Grain boundary and lattice diffusion of silver in zirconium using tracer technique, 20: 43974

**AGEEV, N. V.,** Thermomechanical treatment of the $\beta$ alloy of the Ti–Mo–Cr–Fe–Al system, 20: 43961

**AGRACHEVA, N. D.,** Cytology and cytochemistry of ribonucleoproteins in nervous system during latent period of radiation damage, 20: 42866

**AGUREEV, V. N.,** Polarization of antimony, yttrium, and copper nuclei in iron, 20: 44824

**AHLERS, G.,** Absence of a linear term in the heat capacity of hcp $^4$He, 20: 44527

**AHMADZADEH, A.,** Branching ratio predictions for high energy reactions involving strange particles, 20: 44237

**AHMADZADEH, A.,** Sum rules for high energy scattering phenomena, 20: 44366

**AHMED, S. A.,** Discharge dynamics in the large diameter magnetically confined ion gas laser, 20: 44410

**AINSWORTH, E. J.,** Colony-forming unit repopulation and split-dose radiosensitivity in endotoxin treated mice, 20: 42831 (AD-635600)

**AINSWORTH, E. J.,** Decreased radiation mortality in dogs treated with typhoid-paratyphoid vaccine, 20: 42987

**AINSWORTH, E. J.,** Influence of AET and hypoxia on recovery from radiation injury, 20: 42988

**AINSWORTH, E. J.,** Recovery from radiation injury in sheep, swine, and dogs as evaluated by split-dose technique, 20: 42996

**AKAISHI, J.,** Ingestion, excretion, and accumulation of fallout $^{137}$Cs in man, 20: 42794

**AKCASU, A. Ziya,** Application of Langevin's technique to space- and

energy-dependent noise analysis, 20: 45086

**AKINO, Fujiyoshi,** Measurement of space-dependent source transfer function using pulsed neutron source, 20: 45082

**AKSENTSEV, S. L.,** Phosphorescence of proteins and aromatic amino acids subjected to uv radiation, 20: 42803

**AKSHANOV, B. S.,** Confinement of charged particles pulse-injected into a trap with stationary fields, 20: 44972

**AKULINA, D. K.,** Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)

**ALAGA, G.,** Semimicroscopic description of even Hg spectra, 20: 44788

**ALBERT, Philippe,** Neutron radioactivation determination of S and other elements present in carbazole, 20: 43116

**ALBERTI, Giulio,** Fluorescence of lanthanum ions in aqueous solutions. I., 20: 43210

**ALBERTI, Giulio,** Fluorescence of lanthanum ions in aqueous solutions. II., 20: 43211

**ALBERTI, Giulio,** Fluorescence of lanthanum ions in aqueous solutions. III., 20: 43212

**ALBRECHT, R. W.,** Bias in nuclear reactor power spectral density estimates with finite record lengths, 20: 45091

**ALBURGER, D. E.,** Beta$^+$ radioactivity of $^{30}$S, 20: 44733

**ALEKSEEVA, O. G.,** Action of radiation protection agents during fractional irradiation. III., 20: 42992

**ALEKSENKO, Yu. N.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)

**ALEXANDER, P.,** Site of action of cysteamine in irradiated bacteria, 20: 42802

**ALEXANDROV, L. N.,** Influence of inert gases on tungsten recrystallization, 20: 43937

**ALEXANDROVA, Ye. M.,** Influence of inert gases on tungsten recrystallization, 20: 43937

**ALEXEFF, I.,** Plasma-density measurement in a hollow-cathode arc by arc reversal, 20: 44846 (ORNL-4010)

**ALFORD, W. P.,** Studies of the $^{12}$C($^3$He,$^3$He)$^{12}$C and $^{12}$C($^3$He,$\alpha_0$)$^{11}$C reactions, 20: 44728

**AL-JASIM, H.,** Radiation-induced calcium release from plant tissues, 20: 42916

**ALLDAY, C.,** Enriched uranium fuel cycles, 20: 45180

**ALLEN, D. D.,** New $T \geq 1$ Di-pion at 965 Mev, 20: 44229

**ALLEN, Ralph O. Jr.,** Halogens in chondrites, 20: 44077

**ALLES, W.,** On the $\eta \to \pi^0\gamma\gamma$ decay mode, 20: 44205

**ALLIOT, Jean-Marie,** Consideration on some measurements made on electric arc plasma generators, 20: 44925

**ALLTON, E.,** Photodisintegration of $^6$Li at high energy, 20: 44644 (LNF-66/32)

**ALMOND, E. A.,** Effect of stress on strain ageing, 20: 43965

**ALMOND, P. R.,** Use of lithium fluoride dosimeters for in vivo measurement of transmission through bone and lung, 20: 43747

**ALONSO CERMENO, F.,** Synthesis of amines of high molecular weight for the liquid-liquid extraction of uranium, 20: 43429

**ALPEN, E. L.,** Recovery from radiation injury in sheep, swine, and dogs as evaluated by split-dose technique, 20: 42996

**ALSFORD, R. W.,** Influence of charge effects on the electrical conductivity of thin metal films, 20: 44510

**ALTARELLI, G.,** The SU$_6$ algebra of currents and vector meson decays, 20: 44341

**ALTEMOSE, V. O.,** Outgassing of glass caused by thermal neutrons and gamma radiation, 20: 44011

**ALTER, Harry,** Compilation, evaluation, and production of nuclear data for reactor calculations, 20: 44583 (NAA-SR-11980(Vol. I))

**ALTHUSER, Meinrad,** Filter means for measuring radioactivity of aerosols, 20: 43751

**ALTMANN, H.,** Pasteurization of fruit juices by irradiation, 20: 43787

**ALTRICHTER, S.,** Discoloration of KCl and NaCl crystals under action of gamma radiation, 20: 44996

**ALVAREZ, V.,** Radioprotective properties of 1-phenyl-4,5-(D-glucopyranyl)-imidazoline-2-thione and 1-p-ethoxyphenyl-4-D-arabinyltetrahydroxybutylimidazoline-2-thione, 20: 42979

**ALVAREZ DE BUERGO, L.,** Building a power cell for the fuel handling machine for the DON Reactor, 20: 45163

**ALVAREZ DE BUERGO, L.,** Fuel handling system of the DON Reactor, 20: 45162

**ALVAREZ RAMIS, Concepcion,** Beta and alpha activity levels in area of Andujar U installation, 20: 43001

**AMALRAJ, R. V.,** Development of U-Foam air filters, 20: 43570 (AEET-244)

**AMALRAJ, R. V.,** Incineration of low-level radioactive solid wastes and gas cleaning, 20: 45214 (AEET-243)

**AMALRAJ, R. V.,** Separation and estimation of $^{228}$Ra in Th plant effluent, 20: 43442

**AMATI, D.,** New family of sum rules from current algebra, 20: 44362

**AMATI, D.,** Relation between chiral SU$_3$ × SU$_3$ current algebra and SU$_6$, 20: 44323

**AMBRUS, C. M.,** Mitigation of secondary disease in mice receiving bone marrow, 20: 42995

**AMBRUS, J. L.,** Mitigation of secondary disease in mice receiving bone marrow, 20: 42995

**AMEMIYA, Hiroshi,** Characteristics of cylindrical probe in low-density plasma stream, 20: 44919

**AMERIO, Alessandro,** Lecture on a table of isotopes. II., 20: 44821

**AMERIO, Alessandro,** Table of isotopes, 20: 44820

**AMIEL, J. L.,** Treatment of acute leukemia—actual and possible results, 20: 43045

**AMIEL, S.,** High energy chemical reactions in gaseous phase, 20: 43291 (IA-1096)

**AMMENTORP-SCHMIDT, F.,** Behavior of irradiation products of U in heterogeneous reactions between neutron irradiated U compounds and complexing agents, 20: 43153

**AMON, F.,** Contribution of industry to the fast breeder project with steam cooling, 20: 45150

**ANAND, K. C.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458

**ANANTAKRISHNAN, Sekharipuram V.,** Kinetics of exchange reactions: review of recent developments, 20: 43246

**ANBAR, M.,** H/D isotope effects in formation of H from combination of two radicals in aqueous solutions, 20: 43352

**ANDA, Ricardo,** Intensity recovery after Forbush decreases, 20: 44421

**ANDERS, Oswald U.,** Use of charged particles from Van de Graaff accelerator for elemental surface analysis, 20: 43097

**ANDERSEN, B. L.,** Single-particle widths in $^{207}$Pb(pp) and (pp′) for isobaric analogue state of the ground state of $^{206}$Pb, 20: 44798

**ANDERSEN, H. H.,** Stopping power of Al for 5- to 12-Mev protons and deuterons, 20: 44034

**ANDERSON, K. A.,** Auroral-zone microbursts, 20: 44453

**ANDERSON, R. W.,** Thoria dispersion in uranium, 20: 43902 (NMI-7018)

**ANDERSON, V. E.,** Ladder corrections to the static random-phase-approximation dielectric constant and to positron annihilation in metals, 20: 44247

**ANDERSSON, L. O.,** Temperature variation of $^{139}$La nuclear quadrupole resonance in LaF$_3$, 20: 45026

**ANDJUS, R.,** Effect of local irradiation of head of rats in infantile period on spermatogenesis, 20: 42961

**ANDO, Kozo,** Echelle monochromator and application to ion temperature measurement of He plasma, 20: 44920

**ANDO, Yoshiaki,** Radio contamination in Hokkaido. VI., 20: 43610

**ANDRASSY, L.,** Well-logging in bauxite-prospecting neutron activation logging, 20: 43554

**ANDREEV, B. M.,** Kinetics of isotope exchange between gaseous H and H dissolved in Pd, 20: 43236

**ANDREEV, S. V.,** Maximum permissible concentrations of thoron ($^{220}$Rn) and its daughter products in air of working premises, 20: 43603

**ANDREEV, V. N.,** Reactions by emission of charged particles caused by slow neutrons, 20: 44666 (INDSWG-101, pp 1-22)

**ANDREEVSKII, A. A.,** Boiling potassium heat transfer in tube at moderate vapor content value, 20: 43485

**ANDRES, K.,** Many more superconducting bismuth phases, 20: 44554

**ANDREW, R. W. Jr.,** Radioactivity in bottom sediments of the Clinch-Tennessee Rivers, 20: 45223

**ANDREWS, R. C.,** Design properties of one heat of 2¼ Cr–1 Mo steel and 316 stainless steel in high temperature air, He and Na environments, 20: 43897 (MSAR-66-174)

**ANDRIOT, M.,** Economics and the future of atomic energy, 20: 45166

**ANDRONIKASHVILI, E. L.,** Influence of nuclear irradiation on properties of alkali-halide crystals, 20: 43303

**ANDRONIKASHVILI, E. L.,** Influence of structural dislocations on mechanical properties of irradiated crystals, 20: 43304

**ANDRONIKASHVILI, E. L.,** Quantization of macroscopic motions and hydrodynamics of rotating He II, 20: 44563

**ANDRONIKASHVILI, E. L.,** Radiation effects on dislocation densities in ionic crystals, 20: 43305

**ANDRONOV, A. A.,** Antenna (probe) impedance and noises in cosmic plasma, 20: 44927

**ANDRYUSHIN, N. F.,** Wide-range detector of light pulses, 20: 43722

**ANGELINI, Pio,** Volatile compounds induced by irradiation in basic food substances, 20: 42973

**ANICIN, B. A.,** Resonant frequencies of a reactive structure coupled to a warm plasma, 20: 44887

**ANMINOV, V. V.,** Biological studies carried out in satellites, 20: 42912

**ANSELL, G. B.,** Refinement of the crystal structure of Zn$_2$Mo$_3$O$_8$, 20: 43919

**ANTIPIN, A. A.,** Resonator for studying EPR, 20: 43721

**ANTIPOV, V. V.,** Biological effect of space-flight factors using lysogenic bacteria, 20: 42911

**ANTIPOV, V. V.,** Effect of Vostok-5 and Vostok-6 flights on primary rootlet chromosomes of plant seedlings, 20: 42909

**ANTIPOV, V. V.,** Problem of using radioprotective pharmacological agents under spaceflight conditions, 20: 43004

**ANTIPOV, V. V.,** Radiation protection by mercaptoalkylamines and indolylalkylamines against $\gamma$ rays and proton beams, 20: 43002

**ANTIPOV, V. V.,** Radiation protection during the flight in satellites "Voskhod I" and "Voskhod II", 20: 44990

**ANTIPOV, V. V.,** Radiobiological effects in animals after preliminary action of acceleration, 20: 42985

**ANTONESCU, Elena,** Salts of Dy with various organic acids, 20: 43140

**ANTONIJEVIC, M.,** Nitrogen metabolism in frog liver after whole-body irradiation. V., 20: 42787

**ANTONOV, E. A.,** Soft x-ray detector for the 1 to 12 A range, 20: 43726

**ANTONOV, E. A.,** Wide-range detector of light pulses, 20: 43722

**ANTONOVA, N.,** Photometric Ce determination in cast Fe and alloyed steel with help of tetron, 20: 43143

**AOKI, Masanori,** Calculation of boson mass levels based on the composite model, 20: 44381

Aparicio, J. Lopez

*see Lopez Aparicio, J.*

**APEL, J. R.,** Wave interactions between plasma and electrons in magnetic field, 20: 44853 (AD-630040)

**ARAFA, S.,** Gamma-induced absorption and structural studies of arsenic borate glasses, 20: 44010

**ARAKAWA, E. T.,** Photoelectric and optical properties of Pt, Au, and Pd foils and Al and Ag films, 20: 44995 (ORNL-TM-1392)

**ARAKAWA, E. T.,** Transition radiation and low-energy bremsstrahlung from silver and aluminum foils bombarded by grazing-incidence electrons, 20: 44111 (ORNL-TM-1571)

**ARAKI, K.,** ESR study of free radicals formed by $\gamma$-irradiation of poly(ethylene terephthalate), 20: 43324

**ARBUZOV, S. Ya.,** Radiation protection effect of apilac in animals, 20: 43009

**ARENS, Richard,** Laws like Newton's, 20: 44033

**ARGIERO, L.,** Absorption of fission products by marine organisms, 20: 42770

**ARIEL, Irving M.,** Effects of irradiation on lymphatic dynamics, 20: 42976

**ARMAREGO, W. L. F.,** Proton magnetic resonance spectra of some di- and tri-azanaphthalenes and nitroisoquinolines, 20: 43282

**ARMIGLIATO, A.,** Shell-model states of the oxygen isotopes, 20: 44749

**ARMISTEAD, Fontaine C.,** Radioactivity analysis of a medium utilizing pulsed neutron source, 20: 43163

**ARMSTRONG, D. A.,** Radiation-induced addition of HBr to olefins in the liquid phase, 20: 43298

**ARMSTRONG, George T.,** Contribution to thermochemistry of beryllium fluoride: application of rotating-bomb calorimeter, 20: 43269

**ARMSTRONG, T. P.,** Protons in magnetosphere, 20: 44455

**ARNAUTOV, A. K.,** Problems of experimental and clinical radiobiology, 20: 42796

**ARNDT, R.,** Applicability of electronic differentiation of characteristic curves of probes, 20: 43686

**ARNIKAR, H. J.,** Adsorption of tracers on glass, 20: 43251

**ARNIKAR, H. J.,** Desorption of tracer iodide ions adsorbed on silver, 20: 43250

**ARNIKAR, H. J.,** Isotope exchange reaction between iodide and iodate ions studied by paper chromatography. II., 20: 43248

**ARNIKAR, H. J.,** Tracer study of Liesegang rings. III., 20: 43249

**ARNIKAR, H. J.,** Use of charged plates in the $(n,\gamma)$ radiolysis of bromo and iodo compounds. V., 20: 43367

**ARNOLD, A. J. P. T.,** Oscillations in voltage between two weakly connected current-carrying superconductors, 20: 44561

**ARNOLD, J.,** Development of pulmonary adenomas in mice after treatment of urethane associated with x rays, 20: 42891

**ARNURIUS, D. E.,** Algorithm for a form of the problem $Av = \lambda Bv$, 20: 43805 (ORNL-3980)

**ARONOV, A. G.,** Tunneling current in a transverse magnetic field, 20: 44572

**ARONSON, S.,** Stability of phases in the Cs–graphite system, 20: 43948

**ARSENAULT, R. J.,** Possibility of irradiation damage affecting the rate-controlling mechanism for slip in body-centered cubic metals and solid solutions, 20: 43998 (ORNL-3993)

**ARSENAULT, R. J.,** Strengthening mechanism in neutron-irradiated Cu single crystals, 20: 45030

**ARSEN'EVA, M. A.,** Effect of space-flight factors on hereditary structures of mammals, 20: 42986

**ARTEMEVA, Z. I.,** Method for improving magnetic shielding efficiency, 20: 44060

**ARTHUR, Jett C. Jr.,** Radiation-induced graft polymers of cellulose, 20: 43294

**ARTHUR, Jett C. Jr.,** Radiation-induced interaction of acrylonitrile with cyanoethylated cotton, 20: 43348

**ARTHUR, Jett C. Jr.,** Radiation-induced interaction of styrene with cotton, 20: 43349

**ARTNA, A.,** Revised A chains. $A = 189$, 20: 44716

**ARTSIMOVICH, L. A.,** Thermal insulation of plasma in Tokamak, 20: 44873 (MATT-Trans-35)

**ARUSHANOV, G. G.,** Behavior of the solid part of the forward scattering amplitude and total cross sections at high energies, 20: 44301

**ARVIEUX, J.,** Elastic scattering of polarized deuterons by deuterium at 21.4 Mev, 20: 44231

**ARVIEUX, J.,** Elastic scattering of polarized deuterons from $^{4}$He between 18 and 22 Mev, 20: 44750

**ASATIANI, T. L.,** Ionization measurements in streamer chamber, 20: 43691

**ASBRIDGE, J. R.,** Search for solar neutrons near solar minimum, 20: 44452

**ASCH, M. G.,** Electrification of polyethylene and polystyrene after $\gamma$ irradiation, 20: 43337

**ASEEV, G. G.,** Preliminary photoionization of helium in a gas discharge shock tube, 20: 44980

**ASGHARIAN, A.,** Finite nuclear mass effects on the centrifugal stretching constant in $H^{35}Cl$, 20: 44123

**ASH, Milton,** Optimal shutdown control of nuclear reactors, 20: 45093

**ASLANIDES, E.,** Beta$^{+}$ radioactivity of $^{30}$S, 20: 44733

**AST, D.,** Decays of vacancy agglomerates in neutron-irradiated Ni, 20: 45038

**ASTALDI, G.,** Effect of x rays on proliferative activity of stem cells derived in culture from lymphocytes of human blood, 20: 42872

**ASTBURY, P.,** Charge exchange $\bar{p}p \to \bar{n}n$ at 5, 6, 7, and 9 Bev/c, 20: 44227

**ASTON, John G.,** Thermodynamic studies on the H–Pd system, 20: 43934

**ASTUDILLO, M. D.,** Radioprotective properties of 1-phenyl-4,5-(D-glucopyranyl)-imidazoline-2-thione and 1-p-ethoxyphenyl-4-D-arabinyltetrahydroxybutylimidazoline-2-thione, 20: 42979

**ASUNDI, R. K.,** Effect of reactor radiations on fluorescence spectrum of $RbUO_2(NO_3)_3$, 20: 43365

**ATANASOV, A. A.,** Scattering of slow neutrons by ortho- and parahydrogen, 20: 44591

**ATCHISON, George J.,** Method of polymerizing vinyl ethers, 20: 43379

**ATHAVALE, V. T.,** Chromatographic separation of niobium and tantalum using amines, 20: 43446

**ATHAVALE, V. T.,** Isotopic analysis of Pb by neutron activation method, 20: 43134

**ATKINSON, D.,** Existence of solutions of N/D equations, 20: 44307

**ATTERBURY, T. J.,** Flexibility of nozzles in spherical shells, 20: 43468 (TID-23344)

**AUBRUN, Jean-Noel,** Nuclear magnetic resonance in nickel particles with a single domain, 20: 45000

**AUDOIN, C.,** Permanent-magnet multipolar lens with variable focusing, 20: 44063

**AUERBACH, Daniel,** Alternate-gradient focusing of molecular beams, 20: 44120

**AUGUSTSON, R. H.,** Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)

**AURAND, K.,** Methods for monitoring the radioactivity of waters, 20: 43624

**AURAND, Karl,** Monitoring surface water for radioactive substances by continuous sampling, 20: 43523

**AUSSET, R.,** Problems of disposal into the sea of residual water from the La Hague Centre, 20: 45228

**AUTLER, S. H.,** Radiation-induced peak effect in superconducting Nb–Zr, 20: 44505

**AUXIER, J. A.,** Present status of neutron monitoring for personnel protection, 20: 43671 (ORNL-P-2467)

**AVANZI, Silvana,** Chromatid and chromosome aberrations in irradiated dry seeds of Vicia faba, 20: 42920

**AVENHAUS, Rudolf,** Numerical calculations on high-field superconductivity, 20: 44520

**AVERY, D. G.,** Oxide fuels: how U. K. will fill the need, 20: 43874

**AWSCHALOM, Miguel,** Use of multisphere neutron detector for dosimetry of mixed radiation fields, 20: 43673 (PPAD-596-E)

**AXEL, P.,** Deformation of the Ho nucleus, 20: 44710

**AXFORD, W. I.,** Magnetic field variations in temperate zone sporadic-E layers, 20: 44468

**AXFORD, W. I.,** Shock waves in the interplanetary medium, 20: 44098

**AZARY, Z.,** Increased transistor reliability in nuclear environments, 20: 43754 (EGG-1183-2046)

**AZIMOV, S. A.,** Inelastic p-p interactions at 2.26 Bev, 20: 44189

**AZOVSKAYA, Z. A.,** Injection of particles into a mirror trap through magnetic cusp configuration, 20: 44971

**AZUMA, R. E.,** Properties of the 3.16-Mev level of $^{35}$Cl, 20: 44808

**AZUMA, Toshio,** Activation $(\gamma,n)$, 20: 44681

**AZUMA, Toshio,** Fluorine-19 $(\gamma,n)$ cross section from threshold to 14 Mev, 20: 44683

**AZUMA, Toshio,** Non-pulsed time-of-flight neutron spectrometer, 20: 44592

**AZUMA, Toshio,** Nuclear level of $^{44}$Ca, 20: 44682

B

**BABA, C.,** Reactivation at low temperature of Sabin polyoviruses inacti-

vated by x-rays, 20: 42966
**BABADZHANOV, R.**, Investigation of the decay scheme of $^{138*}$Pr, 20: 44643 (JINR-P-2819)
**BABICKY, Arnost**, Metabolism in epi- and metaphysis after local x irradiation. VIII., 20: 42785
**BABINI, L.**, Electron beam depth dose measurements, 20: 43040
**BABOS, A.**, Reactivation at low temperature of Sabin polyoviruses inactivated by x-rays, 20: 42966
**BACCETTI, Baccio**, Prog. rpt. on effects of radiation on reproductive organs of fruit flies, final, 12/62–12/65, 20: 42847 (NP-16176)
**BADALYAN, A. M.**, Three-body problem: equation for partial waves, 20: 44499
**BAEV, A. K.**, Thermodynamic properties of rare earth chlorides with H and certain metals in gaseous state, 20: 43222
**BAEV, Ilia A.**, Effectiveness of bone marrow transplantation in repeated irradiation of rats, 20: 42956
**BAFFIGO, V.**, Prog. rpt. on release of fission gases from irradiated UO$_2$, 1–3/66, 20: 43992 (EURAEC-1667)
**BAHCALL, John N.**, Predicted and observed features of quasi-stellar sources, 20: 44072
**BAIKOV, A. I.**, Production technology of Nb and Nb alloys, 20: 43984
**BAILEY, J.**, Anomalous magnetic moment of the negative muon, 20: 44207
**BAIR, J. K.**, Search for the trineutron, 20: 44809
**BAIR, J. K.**, Search for the trineutron, 20: 44650 (ORNL-P-2412)
**BAKER, A.**, Site of action of cysteamine in irradiated bacteria, 20: 42802
**BAKER, J. M.**, Sign of interactions between Nd$^{+3}$ ions in LaCl$_3$, 20: 45027
**BAKER, James L.**, Fabrication of Zy-4 clad Zr–2.5 Nb pressure tubing, 20: 43862 (TID-23312)
**BAKER, L. Jr.**, Ignition of uranium, 20: 43611
**BAKER, L. Jr.**, Ignition of binary alloys of uranium, 20: 43612
**BAKER, L. Jr.**, Kinetics of oxidation of U between 300 and 625°C, 20: 43841
**BAKER, P. S.**, Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758
**BAKER, P. S.**, Selected abstracts of non-U. S. literature on production and industrial uses of radioisotopes, 20: 43757 (ORNL-TM-1505(Pt.2))
**BAKH, N. A.**, Liquid-phase radiation-induced carboxylation of hydrocarbons with CO$_2$, 20: 43333
**BAKHTIN, I. A.**, Application of topological methods to the study of critical conditions of a reactor, 20: 45079
**BALAKRISHNAN, K.**, Physics studies of prototype power reactor project, 20: 45104 (AEET-239)
**BALAKRISHNAN, P. V.**, Uranyl chloride complexes of pyrazine and substituted pyrazines, 20: 43243
**BALANDIN, A. A.**, Cracking of cumene over radioactive tricalcium phosphate catalyst, 20: 43391
**BALARIN, M.**, Shift of transformation points between crystalline phases through lattice defects, 20: 45034
**BALASHOV, V. V.**, ($\gamma$,p) and ($\gamma$,n) reactions mechanism in the medium and heavy nuclei region, 20: 44778
**BALASHOV, V. V.**, Nucleon widths of isobaric analogue states in nuclei, 20: 44777
**BALASUBRAMANIAM, K. R.**, Preparation of $^{204}$Tl sources from irradiated Tl metal, 20: 43400
**BAL'BUTSEV, E. B.**, Calculation of nucleon-phonon interaction effects in a simple nuclear model, 20: 44638 (JINR-E-2772)
**BALDOLI, Emildoli**, Presumptive radioprotective action of lysozyme, 20: 42993
**BALDWIN, M. N.**, Doppler coefficient measurements on Th and ThO$_2$ rods with nonuniform temperature distributions, 20: 45088
**BALEBANOV, V. M.**, Lifetime of individual charged particles in mirrored magnetic trap, 20: 44855 (IAE-1078)
**BALLANY, A. K.**, Preparation of useful radioisotopes of high specific activity, 20: 43398
**BALLARINY, Marisa**, Radiometric measurements in selected points of the island of Universitaria, near Guanabara, 20: 43548
**BALTES, H. P.**, Remarks on the physical interpretation of SU(6,6) theory, 20: 44302
**BAME, S. J.**, Search for solar neutrons near solar minimum, 20: 44452
**BAND, I. M.**, Tables giving internal conversion coefficients of gamma-radiation on the K- and L-shells, 20: 44664 (BNL-tr-65)
**BANERJEE, D.**, Lambda-binding energies of hypernuclei. I., 20: 44702
**BANERJI, Partha**, Radium content of rainwater, 20: 43529
**BANKS, Charles V.**, Synergic solvent extraction of rare earths with mixtures of TTA–TOPO, 20: 43100
**BANKS, Peter M.**, Thermal conduction and ion temperatures in the ionosphere, 20: 44430
**BANU, I.**, Effects of ribonuclease and deoxyribonuclease on glutamic acid and methionine uptake in Ehrlich's ascitic carcinoma tumoural cells, 20: 42728
**BANVILLE, Marcel**, Complete variational wave function for the ground state of $^{3}$H and $^{3}$He, 20: 44692
**BANYAI, L.**, Renormalizable field-theoretical model for weak interactions, 20: 44333
**BARA, J.**, Magnetic hyperfine structure of the $^{57}$Fe impurity nucleus, 20: 45033
**BARACCA, A.**, On the $\eta \to \pi^0\gamma\gamma$ decay mode, 20: 44205
**BARALDI, C.**, Response to radiotriolein test in adults and aged persons, 20: 42782
**BARANGER, M.**, Hartree-Fock calculations with a density-dependent interaction, 20: 44785
**BARANOV, E. N.**, Problem of moving of hydrothermal solutions, 20: 43562
**BARANOV, E. N.**, Uranium content in fluorites, 20: 43564
**BARASHENKOV, V. S.**, Charge distribution of particles in a one-meson theory of inelastic interactions at high energies, 20: 44183
**BARBASHOV, B. M.**, Solution of two plane wave scattering problem in nonlinear scalar field theory of the Born-Infeld type, 20: 44399
**BARD, R. J.**, Coated particle fuel elements for UHTREX, 20: 43855 (LA-DC-6954)
**BARDSLEY, J.**, Fabrication of $^{233}$U/Al fuel plates for sub-critical assembly, 20: 43844 (AAEC-TM-315)
**BAREIS, David W.**, Radiation sterilization device with uniformly distributed beta emitters, 20: 43796
**BARENBOIM, G. M.**, Cooled photomultipliers of FEU-39 and FEU-46A types, 20: 43723
**BARGER, V.**, Backward $\pi^+$p elastic scattering from a direct channel $\Delta_\delta$ resonance model, 20: 44236
**BARISH B.**, $\bar{p}$p elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263
**BARKAN, P.**, Stagnation pressure measurement in a current-carrying plasma, 20: 44879
**BARNABA, P.**, Polymerization of tetrafluorethylene oxide, 20: 43301
**BARNES, Russell H.**, Chemical-equilibrium studies of organic-iodide formation under reactor-accident conditions, 20: 43156 (BMI-1781)
**BARNETT, C. H.**, Absorption into rabbit articular cartilage, 20: 42772
**BAR-ON, I.**, Versatile $^{60}$Co irradiation facility within a swimming-pool reactor, 20: 43791
**BARR, Josephine L.**, Virus particles associated with immune responses in Ehrlich ascites tumor cells, 20: 42712 (UCRL-16246, pp 51-7)
**BARR, K. P.**, PWR core 2 seed 1 flux wire measurements, 20: 45125 (WAPD-PWR-TE-203)
**BARR, W. L.**, E × B energy analyzer for electrons, 20: 44957
**BARRETT, B. R.**, Some observations concerning the supermultiplet of negative-parity excited states in the $\alpha$ particle, 20: 44755
**BARRY, J. F.**, Cross section for the reactor $^{6}$Li(n,$\alpha$)T, 20: 44620 (CONF-660303, pp 763-5)
**BARRY, William F.**, Retention, distribution and absorption of inhaled particles, 20: 42797
**BARTEL, W.**, Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 F$^{-2}$, 20: 44253
**BARTH, D. S.**, Bioenvironmental radiation research project, 20: 43574 (CONF-660538-1)
**BARTH, D. S.**, Radioiodine studies following the transient nuclear test (TNT) of Kiwi reactor, 20: 43576 (CONF-660621-7)
**BARTHOLOMEW, G. A.**, Neutron-capture $\gamma$-ray studies in $^{50}$Cr(n,$\gamma$)$^{51}$Cr, 20: 44693
**BARTL, A.**, Radiation corrections for e-p scattering, 20: 44179
**BARUCCHI, G.**, Landau curve of the single-loop scattering diagram, 20: 44342
**BAR'YAKHTAR, V. G.**, Interaction between electromagnetic, plasma, and spin waves in antiferromagnetic semiconductors and metals, 20: 43982
**BASHILOV, A. A.**, Beta spectra of RaD, 20: 44831
**BASS, F. G.**, Nonlinear theory of wave propagation in semiconductors, 20: 44966
**BASU, A. K.**, Effect of beta radiation from $^{35}$S on growth behavior in rice, 20: 42949
**BATANOV, G. M.**, Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)
**BATHGATE, Robert E.**, Mechanical design of the baseball coil and plasma-trapping chamber, 20: 44867 (UCRL-70026)
**BATTEN, E. S.**, Effects of nuclear war on the weather and climate, 20: 43510 (RM-4989-TAB)
**BATTERHAM, T. J.**, Proton magnetic resonance spectra of some di- and tri-azanaphthalenes and nitroisoquinolines, 20: 43282
**BATUSOV, Yu. A.**, Helium-8 production in negative pion capture by carbon and oxygen nuclei, 20: 44770
**BAUDINET-ROBINET, Y.**, Particles of abnormally long path emitted by $^{210}$Po, 20: 44686
**BAUERFEIND, G.**, Determinations of contents in ternary systems by measuring backscattering of secondary electrons and $\beta$-particles, 20: 43120
**BAUMGAERTNER, F.**, Tricyclopentadienylneptunium chloride, 20: 43230
**BAUMGAERTNER, G.**, Optical model for elastic deuteron scattering, 20: 44846
**BAYLE, Pierre**, Measurement of integral flux of fast neutrons by Geiger-Mueller counters with activable cathodes, 20: 43729

**BAZAZYANTS, N. O.,** Elastic scattering of neutrons, 20: 44669 (INDSWG-101, pp 109-57)

**BAZHENOV, V. A.,** Measurements of activity of radioactive gases by spherical ionization chamber, 20: 43106

**BEATTY, Alvin V.,** Prog. rpt. on recovery from x-radiation damage in Tradescantia paludosa, 12/65–12/66, 20: 42977 (ORO-2669-2)

**BEAUDET, C.,** Radiochemical determination of chlorides dissolved in water, 20: 43063 (EUR-2990.f)

**BEAUDET, C.,** Radiochemical determination of oxygen dissolved in water, 20: 43064 (EUR-2991.f)

**BEAVER, W. W.,** Prog. rpt. on intermetallic compounds for very high-temperature applications, 4–6/61, 20: 43886 (BBC-111)

**BECK, Paul A.,** X-ray diffraction study of atomic ordering in two sigma phases, 20: 43890 (COO-1198-385)

**BECKER, E.,** Continuous gamma-ray control of hot rolled ingots before cutting, 20: 43870

**BECKER, K.,** Radiophotoluminescence dosimetry: bibliography, 20: 43689

**BECKER, Richard L.,** Dependence of Brueckner-Hartree-Fock calculations for light nuclei on details of the nucleon-nucleon interaction, 20: 44652 (ORNL-P-2468)

**BEER, O.,** Spectroscopy of $^{208}$Pb by inelastic scattering of protons at 24.55 Mev, 20: 44772

**BEER, O.,** Spectroscopy of $^{207}$Pb by inelastic scattering of 24.5-Mev protons, 20: 44801

**BEGHIAN, L. E.,** Measurement of nonelastic cross section for Pb at 2.1 and 1.7 Mev, 20: 44618 (CONF-660303, pp 726-34)

**BEHOUNEK, F.,** Measurement of airborne active deposit from $^{22}$Rn, 20: 43525

**BEHR, L.,** Decay of the $K^0$ meson into three pions, 20: 44228

**BEIFZWENGER, H.,** Fuel development for a high-temperature fast reactor, 20: 45100

**BEIGMAN, I. L.,** Electron impact ionization cross sections of ions, 20: 44871 (CONF-660332-1)

**BELEN'KII, L. I.,** Formation of radicals in the radiolysis of solid organic compounds. IV., 20: 43330

**BELITZ, H. J.,** Breakdown of an electrodeless ring discharge and the development of the electron density and temperature in a spindle cusp, 20: 44860 (JUL-352-PP)

**BELL, P. R.,** Present status and objectives of DCX-2 experiment, 20: 44856 (ORNL-4011)

**BELL, Vernon L.,** Poly(imidazopyrrolones): a new class of radiation resistant polymers, 20: 43286

**BELLERMANN, W.,** Characteristics of the structural plant (AVR), 20: 45134

**BELLERMANN, W.,** Reactor pressure vessel and load-bearing installations (AVR), 20: 45136

**BELLET, J. C.,** Properties of collision and combustion waves and possibilities of their application of energy conversion, 20: 44174

**BELLIZZI, C.,** Malignant tumors of testicles, 20: 43038

**BELOV, B. G.,** Spring niobium-base alloy with stable elasticity modulus at high temperature, 20: 43963

**BELTRAMETTI, E.,** Interference effects in Coulomb and nuclear scattering of polarized protons, 20: 44741

**BELYAEV, L. I.,** Study of the content of long-lived fission-fragment radionuclides in the Black Sea, 20: 45227

**BELYAEV, V. I.,** Determination of the rate of radioactive contamination of the Black Sea, 20: 43539

**BELYAEVA, L. A.,** Effect of space-flight factors on hereditary structures of mammals, 20: 42986

**BEM, J.,** Bremsstrahlung of electrons with $\bar{E} = 2.4$ Bev, 20: 44190

**BENCZE, Gy.,** Barrier penetrabilities and the alpha-nucleus potential, 20: 44763

**BENDT, Philip J.,** Instability of He II in potential flow between rotating cylinders, 20: 44555

**BENENSON, R. E.,** Proposed recoil technique for neutron-proton differential cross section measurements in the 15-30 Mev range, 20: 44632 (CONF-660303, pp 1084-91)

**BENFENATI, I.,** Integrated dose and neutron spectra resulting from a criticality incident, 20: 43421 (NP-16216)

**BENN, Thomas R.,** Shallow irradiation of oranges by electrons, 20: 43794

**BENNEMANN, K. H.,** Anomalous dependence of the superconducting transition temperature on paramagnetic impurities, 20: 44550

**BENNETT, R. L.,** Characterization of volatile forms of iodine at high relative humidity by composite diffusion tubes, 20: 43582 (ORNL-3985)

**BENNETT, Richmond,** Argon-40 in cogenetic feldspar-mica mineral assemblages, 20: 43503 (COO-689-60, App. A-3)

**BEREZHETSKII, M. S.,** Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)

**BERG, Roger,** Changes in RBE of a 35-Mev electron beam as function of tissue depth, 20: 42974

**BERG, S.,** Neutron flux spectral determination by foil activation, 20: 44579 (CONF-660303, pp 532-53)

**BERGER, Hans Ekkehard,** Model studies on metastases of irradiated malignant tumors, 20: 42963

**BERGER, Rene,** Contribution of the $\alpha$-$\gamma$ and $\beta$-$\gamma$ coincidences using device to analysis of Pu–Am, Np–Pu, Ru, Rh, Zr, and Nb mixtures, 20: 43158

**BERGERON, Daniel J.,** Prog. rpt. on element and energy transfer in lower trophic levels in marine environment, 4/63–3/66, 20: 42731 (RLO-1751-2)

**BERGIA, S.,** Relation between chiral $SU_3 \times SU_3$ current algebra and $SU_6$, 20: 44323

**BERK, N. F.,** Effect of ferromagnetic spin correlations on superconductivity, 20: 44549

**BERKOWITZ-MATTUCK, Joan B.,** High-temperature oxidation. III., 20: 43840

**BERNARDI, L.,** Results of radiotherapy of malignant lung tumors, 20: 43041

**BERNIOLLES, Jean,** Reactor tank of the Beznau Nuclear Power Station, 20: 45167

**BERNOT, Natan,** Building of the TRIGA reactor at Ljubljana, 20: 45212

**BERNSTEIN, S.,** Fluidized bed recovery of F in manufacture of $UF_6$, 20: 43199

**BERRY, David A.,** Prog. rpt. on fission-product deposition and its enhancement under reactor accident conditions, 4–6/66, 20: 45045 (BMI-X-10173)

**BERRY, R. J.,** Direct and indirect effects of radiation: their relation to growth, 20: 43771

**BERRY, Warren E.,** Prog. rpt. on fission-product deposition and its enhancement under reactor accident conditions, 4–6/66, 20: 45045 (BMI-X-10173)

**BERTHOLD, H. J.,** Preparation and x-ray investigation of higher uranium nitrides, 20: 43191

**BERTHOUMIEU, Henri,** Optical path variation of signals generated by a long-wave emitter and propagated in the whistling mode, 20: 44429

**BERTINI, Hugo W.,** Results from low-energy, intranuclear-cascade calculation, 20: 44720

**BERTINOV, A. I.,** Approximate computation of the variation in the electric conductivity of a gas in a vortex magnetohydrodynamic flow, 20: 44412

**BERTMAN, B.,** Some details of flux retention processes in hysteretic superconductors, 20: 44521

**BERTOTTI, Bruno,** Doppler measurement of space-time curvature, 20: 44485

**BERZIN, A. K.,** Determination of oil–water interface based on delayed neutron detection, 20: 43553

**BERZIN, B. Yo.,** Decay component in $\gamma$ scintillations of CsI(Tl) crystals, 20: 43695

**BETTIS, E. S.,** Design studies of 1000-Mw(e) molten-salt breeder reactors, 20: 45116 (ORNL-3996)

**BETZ, H.-D.,** Average charge of stripped heavy ions, 20: 44136

**BETZ, N. A.,** Importance sampling devices for selecting track lengths and directions after scatter in 05R, 20: 44588 (ORNL-TM-1484)

**BEUGNIES, D.,** Sintering of $(U,Pu)O_2$ pellets, 20: 43865 (EURFNR-96F)

**BEVAN, D. J. M.,** Praseodymium–oxygen system, 20: 43967

**BEVERAGE, J. W.,** Radioactivity in bottom sediments of the Clinch-Tennessee Rivers, 20: 45223

**BEVILACQUA, B.,** Changes of daily rhythm of mitosis in Pinus nigra Arn. caused by $\gamma$ rays, 20: 42953

**BEVINGTON, P. R.,** MANIAC: a computer code for correcting neutron scattering angular distributions, 20: 44597

**BEYER, W. A.,** Processing of Pu by ion exchange. VIII., 20: 43418 (LA-3534)

**BHAINDARKAR, J. R.,** Determination of radioruthenium in urine, 20: 43129

**BHARGAVA, B. N.,** Some features of geomagnetic sudden commencements following cosmic-ray flares, 20: 44466

**BHATIA, H. K.,** Fuel cycles in PHWR and CANDU type reactors, 20: 45105 (AEET-252)

**BHATIA, H. K.,** Physics studies of prototype power reactor project, 20: 45104 (AEET-239)

**BHATIA, V. S.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458

**BHATKI, K. S.,** Rapid radiochemical separations of $^{90}$Sr–$^{90}$Y and $^{45}$Ca–$^{46}$Sc on cation exchange resin, 20: 43430

**BHATTACHARYYA, D. K.,** Tetrahydrated double sulfates of tervalent elements with radioactive indicators, 20: 43252

**BHONSLE, R. V.,** Diurnal variation of large-scale ionospheric irregularities, 20: 44450

**BIAGINI, C.,** Dose estimation to active bone marrow in medical uses of ionizing radiation, 20: 43620

**BIALUSCHEWSKI, H.,** Loading device (AVR), 20: 45139

**BIBERGAL, Anatoly Victorovich,** Phantom for determining radiation doses, 20: 43053

**BIEBER, E.,** Conversion electron spectrum of $^{104}$Rh after electron capture, 20: 44848

**BIERMAN, Edwin L.,** Particle-size distribution of low-density plasma lipoproteins, 20: 42717 (UCRL-16246, pp 176-85)

**BIERMAN, Howard R.,** Prog. rpt. on leukopoietic activity, annual, 3/65–

4/66, 20: 42708 (TID-22931)
**BIERMANN, W.,** Effect of alpha bombardment on the diffusion of lead in silver, 20: 44002
**BIGGERSTAFF, George E.,** Prog. rpt. on purification and crystallization of amorphous B powder, annual, 7/65-6/66, 20: 43090 (TID-23342)
**BIKERMAN, Michael,** Isotopic studies in the Roskruge Mountains, Pima County, Arizona, 20: 43502 (COO-689-60, App. A-2)
**BILDSTEIN, H.,** Fabrication methods and evaluation of U–Th–C fuel, 20: 43860 (SGAE-CH-35/1966)
**BILES, Norman,** Measurements of $^{220}$Rn (thoron) in the atmosphere below 50 cm, 20: 43543
**BILWES, L.,** Discrimination of nuclear tracks in ionographic emulsion by electron microscopy, 20: 43731
**BINDER, D.,** Surface effects of radiation on microelectronic devices. II., 20: 43752 (AD-635583)
**BINGLE, J. D.,** Ignition of uranium, 20: 43611
**BINGLE, J. D.,** Ignition of binary alloys of uranium, 20: 43612
**BINGLE, J. D.,** Kinetics of oxidation of U between 300 and 625°C, 20: 43841
**BIRD, J. R.,** Proton microanalysis, 20: 43127
**BIRKHOFF, R. D.,** Photoelectric and optical properties of Pt, Au, and Pd foils and Al and Ag films, 20: 44995 (ORNL-TM-1392)
**BIRKHOFF, R. D.,** Transition radiation and low-energy bremsstrahlung from silver and aluminum foils bombarded by grazing-incidence electrons, 20: 44111 (ORNL-TM-1571)
**BIRNEY, K. R.,** DOLTL: computer code to calculate temperature drift for statically controlled SNAP 10A type reactors, 20: 45198 (NAA-SR-Memo-11977)
**BIRNEY, K. R.,** Effects of prepoison cross section of uncertainties on SNAP reactor performance, 20: 45193 (CONF-660303, pp 204-9)
**BIRSS, I. R.,** High-temperature embrittlement of stainless steel irradiated in fast fluxes, 20: 44015
**BISHAY, A. M.,** Gamma-induced absorption and structural studies of arsenic borate glasses, 20: 44010
**BISHOP, Jerry C.,** Reduction and hydrofluorination of U concentrates by fluid bed techniques, 20: 43200
**BISWAS, Kalyan,** Gravimetric method for cobalt, 20: 43145
**BISWAS, S.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458
**BITHER, T. A.,** Synthesis of Mo and W bronzes at high pressure, 20: 43213
**BITTERLY, Jack G.,** Radiation sterilization device with uniformly distributed beta emitters, 20: 43796
**BIZZETI, P. G.,** Isospin selection rule in the $^{28}$Si(d,$\alpha$)$^{26}$Al reaction, 20: 44841
**BIZZETI-SONA, A. M.,** Isospin selection rule in the $^{28}$Si(d,$\alpha$)$^{26}$Al reaction, 20: 44841
**BLACHMAN, Arthur G.,** Hyperfine structure $^2D_{5/2}$ and $^4F_{9/2}$ states of $^{107}$Ag and $^{109}$Ag, 20: 44141
**BLACK, J. L.,** Collective states of $^{107}$Ag, 20: 44782
**BLACK, S. C.,** Radioiodine studies following the transient nuclear test (TNT) of Kiwi reactor, 20: 43576 (CONF-660621-7)
**BLAINE, R. A.,** Adaptation of ORNL M-GAM code for use at AI, 20: 44586 (NAA-SR-Memo-12019)
**BLAINE, R. A.,** GRISM, code to generate multigroup constants from microscopic neutron cross section data, 20: 44584 (NAA-SR-11980(Vol.3))
**BLAIS, R.,** In vivo intestinal absorption of L-alanine in irradiated rabbits, 20: 42972
**BLANC, Daniel,** Biological activity of natural ionizing radiations, 20: 42886
**BLANCHARD, Richard L.,** Correlation of $^{210}$Pb with $^{90}$Sr in human bones, 20: 42781
**BLAND, C. J.,** High-energy gamma-rays as a means of investigating solar flares, 20: 44093
**BLAND, J. T.,** Mechanism of dimensional changes in crystals of graphites and carbons under fast-neutron irradiation, 20: 44020
**BLANQUET, Paul,** Effect of whole body irradiation by x rays on thyroid metabolism of rat, 20: 43029
**BLASEWITZ, A. G.,** Recovery of $^{233}$U from irradiated thoria, 20: 43415 (ISO-SA-3(Rev.))
**BLATT, J. M.,** Quark model for quasars, 20: 44094
**BLAU, L. M.,** Studies of the $^{12}$C($^3$He,$^3$He)$^{12}$C and $^{12}$C($^3$He,$\alpha_0$)$^{11}$C reactions, 20: 44728
**BLAUGRUND, A. E.,** Doppler-shift lifetime measurements, 20: 44724
**BLINOV, V. A.,** Low-noise $\beta$-counter, 20: 43719
**BLOCH, A.,** Properties of partial radiation widths in $^{196}$Pt, 20: 44807
**BLOCHER, J. M. Jr.,** Fluidized-bed processing of particulate nuclear fuels, 20: 43868
**BLOCK, Wolfram,** Comparison of methods of measuring radioactivity (total $\beta$) in river water, 20: 43601
**BLOK, J.,** Associated particle method for the D(d,n)$^3$He reaction, 20: 44813
**BLOM, Johannes,** Regeneration of locally irradiated bone marrow. I., 20: 42871
**BLOUIN, Florine A.,** Radiation-induced graft polymers of cellulose, 20: 43294
**BLOURI, Julienne,** Neutron radioactivation determination of S and other elements present in carbazole, 20: 43116
**BLUM, J. M.,** Nuclear poisons, 20: 45080
**BLUM, Pierre L.,** System U–$UO_2$ above 1130°C, 20: 43931
**BOBROVSKII, G. A.,** Thermal insulation of plasma in Tokamak, 20: 44873 (MATT-Trans-35)
**BOCCARDI, S.,** Chemical protection of irradiated skin, 20: 42990
**BOCCI, Velio,** Labeling of proteins with $^{131}$I using chloramine T, 20: 43274
**BOCHKAREV, V. V.,** Measurements of activity of radioactive gases by spherical ionization chamber, 20: 43106
**BOCK, R.,** Diffraction model interpretation of heavy-ion induced transfer reactions, 20: 44757
**BODANSKY, D.,** Tests of time-reversal invariance in the reactions $^{24}Mg + d \rightleftarrows {}^{25}Mg + p$, 20: 44805
**BOEBEL, G.,** Interference effects in Coulomb and nuclear scattering of polarized protons, 20: 44741
**BOEHM, F.,** Determination of the gyromagnetic ratios of some odd-A deformed nuclei from branching ratio measurements, 20: 44791
**BOEHM, H.,** Irradiation behavior of tempered Ni–Cr–Fe alloy, 20: 44013
**BOESCH, R.,** Direct determination of a short nuclear lifetime ($\approx 10^{-20}$s) by the proximity scattering method, 20: 44731
**BOGARD, D. D.,** Mass yield spectrum of cosmic-ray-produced xenon, 20: 44079
**BOGART, Donald,** Boron cross sections as a source of discrepancy for capture cross sections in the kev region, 20: 44611 (CONF-660303, pp 486-501)
**BOGDANKEVICH, L. S.,** Drift-cyclotron oscillations of a collision plasma propagating across a magnetic field, 20: 44968
**BOHM, George J.,** Solution of nonlinear vibration problems in reactor components, 20: 45061
**BOHNE, Felicitas,** Excretion of radionuclides (investigations on radiocesium), 20: 42786
**BOISOT, M. H.,** Disinsectization of African dried and smoked fish by means of irradiation, 20: 43778
**BOKROS, J. C.,** Neutron-induced changes in crystallinity and thermal conductivity of pyrolytic carbons, 20: 44009
**BOKROS, J. C.,** Structure and properties of pyrolytic carbons prepared in a fluidized bed between 1900 and 2400°C, 20: 43930
**BOLDT, Elihu,** Extended source of energetic cosmic x rays, 20: 44095
**BOLDT, Werner,** Nozzle current of a hypersonic argon plasma jet, 20: 44886
**BOLDYREV, V. V.,** Effects of admixtures on radiolysis of potassium nitrate, 20: 43329
**BOLLINGER, L. M.,** New approach to neutron resonance spectroscopy, 20: 44631 (CONF-660303, pp 1064-72)
**BOL'SHOI, A. A.,** Certain regularities in formation of heterogenities in the ionosphere and their relation to the particle fallout from cosmic space, 20: 44157
**BOLSUN, A. I.,** Formation of the photon pairs of the polarized vector W-mesons, 20: 44277
**BOLTON, J. G.,** Identification of radio galaxies and quasi-stellar objects, 20: 44090
**BOMSE, F.,** Search for a baryon of positive strangeness, 20: 44195
**BONANNI, G.,** Radiological and scintillation investigations of hepatitic compressions, 20: 43036
**BONATI, P.,** Localization of radiferous sources for dosage calculation in interstitial radium therapy. I., 20: 43616
**BONAZZOLA, G. C.,** Neutron (14 Mev) studies on Cl, 20: 44746
**BOND, V. P.,** Bone marrow stem cell survival in nonuniformly exposed mammal, 20: 42844 (BNL-10385)
**BOND, V. P.,** Hematopoietic stem cell function of lymphoid cells of blood, 20: 42784
**BONDAR, I. A.,** Infrared spectra of rare-earth pyrogermanates and structure of $Ge_2O_7$ anions, 20: 43218
**BONDORF, J. P.,** Single-particle widths in $^{207}$Pb(pp) and (pp') for isobaric analogue state of the ground state of $^{208}$Pb, 20: 44798
**BONNIAUD, R.,** Survey of the studies conducted in France on the solidification of concentrated fission product solutions, 20: 45231
**BONO, F.,** Conventional and high energy radiotherapy in treatment of malignant tumors of rhino-pharynx, 20: 43042
**BONO, F.,** Results of radiotherapy of malignant lung tumors, 20: 43041
**BOONE, M. L. M.,** Use of lithium fluoride dosimeters for in vivo measurement of transmission through bone and lung, 20: 43747
**BOPP, F.,** New principles for quantization of relativistic field theories, 20: 44284
**BORCHERS, R. R.,** Continuous neutron spectra from (p,n) reactions, 20: 44739
**BOREK, Carmia,** In vitro cell transformation by x irradiation, 20: 42927
**BORELOWSKI, Z.,** Approximate solution to field equations of two relativistic models of spin particles, 20: 44481
**BORENSTEIN, S.,** Search for a baryon of positive strangeness, 20: 44195

**BORESCKOV, G. K.,** Kinetics of isotope exchange between gaseous and H and H dissolved in Pd, 20: 43236
**BORIANI, G.,** Effects of x radiation on RNA of neoblasts of Polycelis nigra during regeneration, 20: 42933
**BORISHANSKII, V. M.,** Boiling potassium heat transfer in tube at moderate vapor content value, 20: 43485
**BORISOVA, A. K.,** Spring niobium-base alloy with stable elasticity modulus at high temperature, 20: 43963
**BOROVIK, E. S.,** Pre-heated diffusion pumps, 20: 43498
**BOROVIK, E. S.,** Sputtering of stainless steel by $H_1^+$ ions, 20: 44131
**BOROWITZ, Sidney,** Prog. rpt. on calculations in atomic scattering and structure, 5/60–2/66, 20: 44108 (AD-630172)
**BORSE, G. J.,** Core excitation of $^{20}$Ne, 20: 44792
**BOSCO, B.,** Isotopic-spin selection rules and mechanism of reactions involving virtual photons in light nuclei, 20: 44744
**BOT, C.,** Associated particle method for the D(d,n)$^3$He reaction, 20: 44813
**BOTEZATU, Nicu Paul,** Use of radioactive isotopes in hydrogeological research, 20: 43555
**BOTIS, S.,** Reactivation at low temperature of Sabin polyoviruses inactivated by x-rays, 20: 42966
**BOTSTEIN, Charles,** Changes in RBE of a 35-Mev electron beam as function of tissue depth, 20: 42974
**BOTTI, G.,** Electron beam depth dose measurements, 20: 43040
**BOUCHE, R.,** Comparison of (d,t) and (d,$^3$He) cross sections, 20: 44794
**BOUCHIAT, C.,** Sum rules from the algebra of current densities, 20: 44326
**BOUGNOL, M.,** Monitoring and control of radioactivity of waters used for agricultural purposes, 20: 43598
**BOURDON, P. A.,** Nb-1 Zr alloy Li corrosion loop tests, 20: 43837 (TIM-823)
**BOURRELY, Claude,** Low-energy P(1/2,1/2) resonance in Chew-Low model, 20: 44186
**BOUSKELA, R.,** Renal phlebography by selective angiography using ultra fluid lipiodol emulsion, 20: 43024
**BOUTEN, M.,** Hartree-Fock type calculation of $^{12}$C, 20: 44779
**BOVENKO, V. N.,** Stress relaxation in uranium, 20: 43936
**BOX, Harold C.,** Transfer processes in irradiated crystalline solid solutions, 20: 43317
**BOYD, G. M.,** Solar eclipse magnetic observations and Pc-1 geomagnetic micropulsations, 20: 44432
**BOYD, T. J. M.,** Light scattering by plasmas, 20: 44938
**BOYD, W. S.,** Prog. rpt. on supercritical technology, 10–12/64, 20: 45098 (WCAP-3374-4)
**BOYER, R. H.,** Rotating fluid masses in general relativity. II., 20: 44495
**BRADBURY, J. H.,** Structural studies of ribonuclease. XXIV., 20: 43281
**BRADLEY, D. L.,** Two-state theory of the structure of $D_2O$, 20: 44032
**BRADLEY, Eugene T.,** ASTRON alignment system, 20: 44866 (UCRL-70025)
**BRADLEY, R. F.,** Radiolytic peroxidation of p-xylene, 20: 43369
**BRADSHAW, R. L.,** Model and underground studies of the influence of stress, temperature, and radiation on flow and stability in rock salt mines, 20: 45217 (ORNL-P-2126)
**BRADY, Luther W.,** Symposium on advances in nuclear medicine, 3/65, 20: 43051
**BRAGIN, Yu. A.,** Direct measurements of the concentration of ions and electrons in the stratosphere and mesosphere, 20: 44463
**BRAITHWAITE, W. J.,** Tests of time-reversal invariance in the reactions $^{24}\mathrm{Mg} + d \rightleftarrows {}^{25}\mathrm{Mg} + p$, 20: 44805
**BRAMBLETT, E. L.,** DRUTES: code to calculate design points of an unmanned, direct-radiating, thermoelectric system, 20: 45195 (NAA-SR-Memo-11819)
**BRANCA, Guido,** Waste processing plant of Rospo and Ispra-2 reactors, 20: 45220
**BRANCADORO, P.,** Anomalies induced by ionizing radiation on human chromosomes, 20: 42931
**BRANCADORO, P.,** Dose estimation to active bone marrow in medical uses of ionizing radiation, 20: 43620
**BRANDOLINI, F.,** Shell-model states of the oxygen isotopes, 20: 44749
**BRANDT, A.,** Prog. rpt. on equations of motion of viscous fluid, final, 8/25/65. I., 20: 44404 (AD-628179)
**BRANDT, N. B.,** de Haas-Van Alphen effect in Sb at ultralow temperatures, 20: 44569
**BRANDT, N. B.,** Effect of high pressure on superconducting transition temperature of 90Mo–10Re and 75Nb–25Mo, 20: 44568
**BRANICA, M.,** Polarographic study of reduction and dismutation of U in aqueous solutions of acetylacetone, 20: 43205
**BRANTLEY, W. H.,** L subshell ratios of E2 transitions in deformed rare earth nuclei, 20: 44701
**BRASACK, G.,** Occupational radiation exposures in the German Democratic Republic in 1964, 20: 43614
**BRATER, D. C.,** Mechanically agitated fluid beds applied to hydrofluorination of UO powders, 20: 43198
**BRAUER, K. H.,** Scattering of electrons on residual gas, 20: 44114
**BRAUN, H.,** Complete installation of the AVR Reactor, 20: 45133
**BRAUN, Heribert,** Behavior of kidney-, liver-, and serum esterase of rats following irradiation, 20: 42824
**BRAUN, Heribert,** Radiation sensitivity of rats in state of hyperthermia, 20: 42959
**BRAUN, M. A.,** Singularities of the electron Green function, 20: 44397
**BRAUNSCHWEIG, M.,** Single photoproduction of neutral $\pi$-mesons on hydrogen at small angles between 1.3 and 3 Bev, 20: 44242
**BRAUTTI, G.,** Charge exchange $\bar{p}p \to \bar{n}n$ at 5, 6, 7, and 9 Bev/c, 20: 44227
**BREEDIS, J. F.,** Microstrain behavior of beryllium single crystals, 20: 43924
**BRESLIN, A. J.,** Community aspects, 20: 43629
**BRESLIN, A. J.,** Exposures and patterns of disease in Be industry, 20: 42752
**BRESLIN, A. J.,** Occupational health aspects, 20: 43628
**BRESSANI, T.,** Neutron (14 Mev) studies on Cl, 20: 44746
**BRETSCHER, M. M.,** Low flux determination of capture-to-fission ratio, 20: 45071 (CONF-660303, pp 1092-7)
**BREUR, K.** Growth rate and radiosensitivity of tumors in man, 20: 43033
**BRIANCON, Chantal,** Existance of satellite bands in the spectra of internal conversion electrons, 20: 44696
**BRICKSTOCK, A.,** Measurements and calculations of the Doppler effect on the reactions $^{238}$U(n,$\gamma$), $^{235}$U(n,f) and $^{239}$Pu(n,f) with neutrons in the energy range 0-25 kev, 20: 44627 (CONF-660303, pp 933-8)
**BRIDGES, Bryn A.,** Mechanism of uv mutagenesis in E. coli, 20: 42918
**BRIMHALL, J. L.,** Defect structures in neutron irradiated nickel, 20: 4399 (BNWL-SA-782)
**BRIMHALL, J. L.,** Deformation structure of neutron-irradiated Cu–Al alloy, 20: 44003
**BRINKMANN, D.,** Local magnetic field shift in liquid and solid xenon, 20: 44142
**BRINKWORTH, M. J.,** METHUSELAH II FORTRAN program and nuclear data library for physics assessment of liquid-moderated reactors, 20: 45063 (AEEW-R-480)
**BRISSON, V.,** Decay of the $K^0$ meson into three pions, 20: 44228
**BRIZES, Wm. F.,** Carbon diffusion in the carbides of niobium, 20: 43954
**BROCKMAN, R. H.,** Condensed tables for x-ray fluorescence analysis, 20: 43057 (AAEC-TM-321)
**BRODE, Harold L.,** Survey of weapons and hazards which may face people of United States in wartime, 20: 43566 (AD-625251)
**BRODERSEN, K.,** Inactive pilot plant studies of a process for vitrification of highly radioactive waste at the research establishment, Risoe, 20: 45230
**BRODIE, Arnold F.,** Oxidative phosphorylation in fractionated bacterial systems. XXII., 20: 42810
**BRODSKII, A. M.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)
**BROECKER, Wallace S.,** Isotope geochemistry and the Pleistocene climatic record, 20: 43557
**BROHER, H.,** Prevention of nuclear damage in irradiated rat thymocytes by deprivation, 20: 42989
**BROMBERG, Edward E. A.,** Alternate-gradient focusing of molecular beams, 20: 44120
**BROMKAMP, K.-H.,** Startup and operation testing (AVR), 20: 45145
**BROMLEY, D. A.,** Masses of $^{12}$N, $^{24}$Al, $^{28}$P, $^{32}$Cl, and $^{40}$Sc, 20: 44811
**BRONING, M. F.,** Fluidized-bed processing of particulate nuclear fuels, 20: 43868
**BRONZAN, J. B.,** Two-meson solution of the charged scalar static model, 20: 44316
**BROOKS, Edward J.,** Reactor fuel temperature and thermal time constant measurements with W–Re thermocouples, 20: 45209
**BROSSARD, J.,** Properties of collision and combustion waves and possibilities of their application to energy conversion, 20: 44174
**BROSSARD, J. P.,** Continuous calcination of molybdenum solutions. II., 20: 43186 (ORNL-tr-1344)
**BROU, Lin,** Effects of $^{60}$Co radiation on the melanophores of Gambusia affinis and Mollienisia latipinna, 20: 42905
**BROWN, Leon J.,** High pressure $^3$He gas sciatillation neutron detector, 20: 43733
**BROWN, R. C. A.,** Anomalous magnetic moment of the negative muon, 20: 44207
**BROWN, Theodore L.,** Organometallic exchange reactions. II., 20: 43392
**BROWN, Theodore L.,** Organometallic exchange reactions. III., 20: 43393
**BROWN, W. D.,** Prog. rpt. on radiation of heme protein, 10/65–9/66, 20: 42799 (UCB-34P95-1)
**BROWNE, Cornelius P.,** Isobaric spin reactions in light nuclei, 20: 44834
**BROWNING, W. E. Jr.,** Characterization of volatile forms of iodine at high relative humidity by composite diffusion tubes, 20: 43582 (ORNL-3985)
**BROWNING, W. E. Jr.,** Removal of radioactive methyl iodide from steam–air systems, 20: 45049 (ORNL-P-2431)
**BROYLES, A. A.,** Variational method for the ground state of liquid $^4$He, 20: 44491
**BRUGE, G.,** Quadrupole and octupole excitations of spherical even-even

nuclei in the region of closed shells, 20: 44799
**BRUGE, G.**, Second-order excitation in the inelastic scattering of $\alpha$ particles, 20: 44795
**BRUNO, Roberto**, Fluorescence of lanthanum ions in aqueous solutions. III., 20: 43212
**BRUNORI, A.**, Chromatid and chromosome aberrations in irradiated dry seeds of Vicia faba, 20: 42920
**BRUSCHI, L.**, Measurement of a barrier for the extraction of excess electrons from liquid helium, 20: 44556
**BRUSH, S. G.**, Monte Carlo study of a one-component plasma. I., 20: 44910
**BRUSTON, P.**, Auroral-zone proton-electron anticorrelations, proton angular distributions, and electric fields, 20: 44442
**BRUSTON, P.**, Properties of auroral-zone electron source, 20: 44441
**BRYANT, B. J.**, Hematopoietic stem cell function of lymphoid cells of blood, 20: 42784
**BUBAR, S. F.**, Deformation of anodic oxide films, 20: 43949
**BUBEN, N. Ya.**, Formation of radicals in the radiolysis of solid organic compounds. IV., 20: 43330
**BUBERNAK, J.**, Improvements in precise measurement of gamma activity, 20: 43074 (LA-DC-7831)
**BUCCELLA, F.**, W-spin constraints on eventual C-violating electromagnetic interactions, 20: 44198
**BUCHANAN, M. G.**, APT post processor for positioning machines, 20: 45238 (K-1675)
**BUCHEL, Gerald L.**, Preparation and some properties of $Nd_2O_2C_2$, 20: 43214
**BUCHEL'NIKOVA, N. S.**, Excitation of ionic-acoustic waves in a potassium and cesium plasma, 20: 44960
**BUCK, J. S.**, Irradiation behavior of unalloyed hypostoichiometric UC, 20: 45113 (NAA-SR-11440)
**BUDBERG, P. B.**, Effect of V and Mo on properties and phase conversions of $TiCr_2$, 20: 43970
**BUDZINSKI, Edwin E.**, Transfer processes in irradiated crystalline solid solutions, 20: 43317
**BUECKLE, H.**, Problems of protective coatings for refractory materials, 20: 43877
**BUEHLER, F.**, Trapping of the solar wind in solids. I., 20: 44697
**BUESSER, F. W.**, Scattering of polarized neutrons by $\alpha$ particles, 20: 44732
**BUFORD, John T.**, Prog. rpt. on purification and crystallization of amorphous B powder, annual, 7/65-6/66, 20: 43090 (TID-23342)
**BUKATA, Robert P.**, Observations of the low-energy photon fluxes during the solar approach of the Ikeya-Seki comet, 20: 44158
**BUKIN, I. I.**, Automatic magnetic field calibrator for EPR microwave spectrometers, 20: 43720
**BULA, K.**, Inspection window with grooved metallic seal: problem in the nuclear reactor sector, 20: 45062
**BULATOV, B. P.**, Soft x-ray detector for the 1 to 12 A range, 20: 43726
**BULATOV, B. P.**, Wide-range detector of light pulses, 20: 43722
**BULL, Gerald V.**, Ionospheric winds measured by gun-launched projectiles, 20: 44447
**BUNCH, D. F.**, Environmental effects from operation of the waste calcination facilities, 20: 45219
**BUNYATOV, S. A.**, Helium-8 production in negative pion capture by carbon and oxygen nuclei, 20: 44770
**BURCH, W. D.**, Philosophy of chemical processing equipment design and installation in Transuranium Processing Plant, 20: 43425 (ORNL-P-2406)
**BURCHSTED, C. A.**, Requirements for fire-resistant high-efficiency particulate air filters, 20: 43583 (ORNL-P-2387)
**BURDET, G.**, Remark about the regularization method, 20: 44330
**BURG, C.**, Importance of mud and suspended matter in transport and elimination of radionuclides contained in surface waters, 20: 43544
**BURG, C.**, Suppression by x irradiation of syngenic preference phenomenon, 20: 42889
**BURIANEK, J.**, Radiochemical purity of sodium chromate $^{51}Cr$ injections, 20: 43114
**BURK, Werner**, Precipitation of uranium dioxide from alkali chloride melts, 20: 43185 (ZFK-WF-25)
**BURKHALTER, L. C.**, Accountability of $UF_6$ supplied to Paducah Gaseous Diffusion Plant by private firm, 20: 43062 (CONF-661011-1)
**BURLACHENKO, G. A.**, Problems of experimental and clinical radiobiology, 20: 42796
**BURLAKOVA, E. V.**, Electric conductivity and autolysis of muscle tissues in irradiated animals, 20: 42929
**BURMAN, R.**, Coupled-wave equations for propagation in stratified compressible magnetoplasmas, 20: 44899
**BURMAN, R.**, Transverse propagation of electromagnetic waves in a cylindrically stratified axially magnetized plasma, 20: 44951
**BURNASHOVA, V. A.**, Ternary chemical compounds Ni–Ti–Nb system, 20: 43971
**BURNHAM, J. B.**, Comparative costs of oxide and fuel elements, 20: 43849 (BNWL-273(Vol.1 and App.))
**BURNHAM, J. B.**, Effect on fuel element costs when certain reference values are varied, 20: 45095 (BNWL-273(Vol.3))
**BURNS, G.**, $Cr^{3+}$ and rare earth doped $LiNbO_3$, 20: 43242
**BURNS, R. H.**, Radioactive wastes: their treatment and disposal, 20: 45222
**BURRILL, E. Alfred**, Particle accelerator uses by industry, 20: 44051
**BURRUS, W. R.**, Proton-recoil neutron spectrometry with organic scintillators, 20: 43672 (ORNL-P-2471)
**BURSON, Z. G.**, Radiation measurements in residential structures, 20: 43496 (CEX-59.7B(Pt.1))
**BURT, W. R. Jr.**, Improvements in consolidation and fabrication of V-20 wt.% Ti (TV-20), 20: 43846 (ANL-7127)
**BUSCARONS, F.**, Reactivity and possible applications of imidodioximes: maleimide dioxime and 1,2,3,6-tetrahydrophthalimide dioxime, 20: 43095
**BUSCH, R.**, Dynamic strain aging of a high-strength steel, 20: 43915 (UCRL-16761)
**BUSSIERE, A.**, Quadrupole and octupole excitations of spherical even-even nuclei in the region of closed shells, 20: 44799
**BUSSIERE, A.**, Second-order excitation in the inelastic scattering of $\alpha$ particles, 20: 44795
**BUT, D. A.**, Approximate computation of the variation in the electric conductivity of a gas in a vortex magnetohydrodynamic flow, 20: 44412
**BUTHERUS, A. Duane**, Preparation and some properties of $Nd_2O_2C_2$, 20: 43214
**BUTLER, D. K.**, Theoretical and experimental physics studies of tungsten based nuclear rockets, 20: 45199
**BUTLER, G. W.**, Calcium-37 and the mass 37 $T = \frac{3}{2}$ quartet, 20: 44659 (UCRL-16990)
**BUTTERWORTH, Ian**, Evidence for a $K^*(1320)$ resonance, 20: 44265
**BYCHKOVSKAYA, I. B.**, Dynamics of lethal radiation effects in biological species, 20: 42934
**BYKOV, G. S.**, Boiling potassium heat transfer in tube at moderate vapor content value, 20: 43485
**BYRON, J. W.**, Radioprotection in total-body-irradiated primates, 20: 42980
**BYURGANOVSKAYA, G. V.**, Glass-base dosimeters with optical density changes induced by radiation, 20: 43679

# C

**CABIBBO, N.**, Possible vanishing of strong interaction cross-section at infinite energies, 20: 44206
**CADOFF, L. H.**, Carbon diffusion in the carbides of niobium, 20: 43954
**CAHILL, J. A.**, Containment of liquid Zr and Nb carbides on graphite between 3500 and 4700°K, 20: 43174 (NASA-CR-608)
**CAHILL, J. A.**, Prog. rpt. on high temperature inorganic chemistry, annual, 7/65–7/66, 20: 43179 (NYO-2082-6)
**CAHILL, Laurence J. Jr.**, Inflation of magnetosphere during magnetic storm, 20: 44445
**CAJAL, N.**, Reactivation at low temperature of Sabin polyoviruses inactivated by x-rays, 20: 42966
**CALDWELL, Roger D.**, Local tissue dose from insoluble particles of $^{90}Sr$, 20: 43631
**CALHOUN, C. D.**, Ductile-to-brittle transition of Nb–V alloys, 20: 43893 (KAPL-3119)
**CALHOUN, C. D.**, Ductile-to-brittle transition of Nb–V alloys, 20: 43894 (KAPL-3146)
**CALUCCI, G.**, Bound states of a relativistic system, 20: 44335
**CAMERON, J. R.**, Effects of pre-irradiation annealing on the thermoluminescence and dielectric loss of LiF:Mg, 20: 45008
**CAMPBELL, D.**, ESR study of free radicals formed by $\gamma$-irradiation of poly(ethylene terephthalate), 20: 43324
**CANO, Renato**, Allowed bands for wave generation through nonlinear effects in a plasma, 20: 44893
**CANTEL, J.**, Problems of disposal into the sea of residual water from the La Hague Centre, 20: 45228
**CANTONI, Vittorio**, Class of representations of the generalized Bondi-Metzner group, 20: 43807
**CARAZZA, B.**, Isotopic-spin selection rules and mechanism of reactions involving virtual photons in light nuclei, 20: 44744
**CARDEN, Joan E.**, Applications of kryptonates in materials research, 20: 43765
**CARDEN, Joan E.**, Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758
**CARLILE, R. N.**, Quasi-$TE_{11}$ modes in anisotropic plasma waveguide, 20: 44903
**CARLSON, Walter O.**, Variable collision cross-section effects on electrical conductivity, 20: 44877
**CARNEY, H. C.**, Summary of RISE power conversion system selection, 20: 43799 (NP-16281)
**CARO, Claude**, Cryogenic equipment, 20: 44501 (CEA-R-3008)
**CARPENTER, D. W.**, Experimental investigation of CP violation in $K_{e3}^{0}$ decays, 20: 44259
**CARR, H. Y.**, Local magnetic field shift in liquid and solid xenon, 20: 44142

**CARRIGAN, P. H. Jr.**, Radioactivity in bottom sediments of the Clinch-Tennessee Rivers, 20: 45223
**CARTER, G.**, Ion bombardment of glass, 20: 45017
**CARTER, H. G.**, Discrepancy between experimental and predicted cross sections for the $^{93}$Nb(n,2n)$^{92}$Nb reaction, 20: 44616 (CONF-660303, pp 682-9)
**CARTER, H. G.**, 14-Mev differential cross section of $^{93}$Nb, 20: 44615 (CONF-660303, pp 675-81)
**CARTER, W. L.**, Fluorination—vacuum-distillation system for regenerating fuel and fertile streams in MSBR, 20: 43422 (ORNL-3791)
**CARTER, William J.**, Spectrum of Er(IV), 20: 43175 (NP-16301)
**CARTWRIGHT, H.**, SGHWR: a dark-horse competitor, 20: 45173
**CASTELL, C. H.**, Gamma irradiation as means of extending storage life of haddock fillets, 20: 43770
**CASTRO, D. L.**, Mechanically agitated fluid beds applied to hydrofluorination of UO powders, 20: 43198
**CATCHPOOLE, J. R.**, Longitudinal drift effects and further aspects of superimposed electric fields, 20: 44434
**CATSCH, Alexander**, Behavior of radioactive zinc-chelates in mammalian organisms, 20: 42789
**CATTAN, A.**, Treatment of acute leukemia—actual and possible results, 20: 43045
**CAUTIUS, W.**, Why does the AVR support the high-temperature reactor development?, 20: 45130
**CAVALLO, F.**, Dose estimation to active bone marrow in medical uses of ionizing radiation, 20: 43620
**CAVERO GRANDE, Bonifacio**, Separation of Ca, Ba, Sr, and Cs using heated exchange resins, 20: 43436
**CAWTHORNE, C.**, High-temperature embrittlement of stainless steel irradiated in fast fluxes, 20: 44015
**CAZAUX, Jacques**, Effect of crystalline environment on energy loss of electrons traversing a crystal, 20: 45003
**CECHACEK, Zdenek**, Relative dosimetric measurements of a well irradiator, 20: 43613
**CECIL, Olin B.**, Anomalous effect of electron beam irradiation on silicon and silicon and germanium, 20: 44998
Cermeno, F. Alonso
*see* *Alonso Cermeno, F.*
**CERNY, J.**, Calcium-37 and the mass 37 T = $^3/_2$ quartet, 20: 44659 (UCRL-16990)
**CEROVIC, Danica**, Thermodynamic characteristics of self-diffusion in $\alpha$-uranium, 20: 43928
**CEULEMANS, H.**, Spin measurement of the 8.8 ev neutron resonance in $^{235}$U by means of the resonant scattering method, 20: 44619 (CONF-660303, pp 755-62)
**CHADDERTON, L. T.**, Fission fragment damage to crystal lattices: lead iodide. I., 20: 44023
**CHADDERTON, L. T.**, Fission fragment damage to crystal lattices: lead iodide. II., 20: 44024
**CHAHOUD, J. N.**, Relativistic impulse approximation for $\pi$-d elastic scattering, 20: 44210
**CHAHOUD, J. N.**, Theory of deuteron production in proton-proton collisions, 20: 44196
**CHAIKO, Yu.**, Isotope shifts of resonance lines in the spectrum of ytterbium, 20: 44133
**CHAKRABORTY, K. P.**, Tagging of hippuran with radioiodine ($^{131}$I), 20: 43403
**CHAMPION, A. R.**, Versatile high pressure Moessbauer apparatus, 20: 43732
**CHAN, C. H.**, Sum rules for high energy scattering phenomena, 20: 44366
**CHAN, F. C.**, Decay widths and magnetic moments of vector mesons in relativistic SU$_6$, 20: 44203
**CHAN, F. C.**, Quark model and S-wave nonleptonic hyperon decays, 20: 44199
**CHANDRASEKARAN, V. R.**, Radiochemical determination of $^{90}$Sr and $^{137}$Cs in drinking water and milk in Bombay, 20: 43532
**CHANG, Kuang-yang**, Measurement of inelastic scattering cross section of Al by 2.52-Bev neutron, 20: 44828
**CHANG, Roger**, Low-temperature elastic properties of ZrC and TiC, 20: 43942
**CHANG, Shau-jin**, Spin-½ system without intrinsic magnetic moment, 20: 44369
**CHANG, Shu-Ming**, Paper chromatographic study on distribution of product formed from Ph$_3$(RaD)I after $\beta$-disintegration, 20: 43406
**CHAO, Ching-an**, Radiation for automatically controlling level of liquid metal in crystallizer when steel is cast, 20: 43761
**CHAPIRO, Adolphe**, Chemical nature of reactive species produced in polymers by radiations, 20: 43370
**CHAPIRO, Adolphe**, Radiochemical polymerization of acrylonitrile in crystallized state, 20: 43277
**CHARLES, G. W.**, Spectra of $^{208}$Po and the hyperfine structure of $^{209}$Po, 20: 44128
**CHARLESBY, A.**, Effect of alpha and gamma radiation on an enzyme, 20: 42816
**CHARPENEL, Marc**, Operation of plasma accelerators using progressive waves, 20: 44891
**CHARRUYER, J.**, Measurement of radioactivity of water, 20: 43124
**CHASE, L. M.**, Auroral-zone microbursts, 20: 44453
**CHATTERJEE, Anita**, Uptake of $^{89}$Sr and $^{90}$Sr by CaSO$_4$ and its role in morphological and geochemical studies, 20: 43534
**CHATTERJEE, G. P.**, Gravimetric method for cobalt, 20: 43145
**CHATTERJEE, S. D.**, Radium content of rainwater, 20: 43529
**CHAUDRON, Thierry**, Neutron radioactivation determination of S and other elements present in carbazole, 20: 43116
**CHAVANON, P.**, Production of isospin 1 resonances in the reaction P + P = D + (missing mass), 20: 44243
**CHELLEW, N. R.**, Preparation of $^{24}$Mg from $^{24}$MgO, 20: 44717
**CH'EN, Chin-hsien**, Measurement of inelastic scattering cross section of Al by 2.52-Bev neutron, 20: 44828
**CHEN, Chihi Yueh**, Paper chromatographic study on distribution of product formed from Ph$_3$(RaD)I after $\beta$-disintegration, 20: 43406
**CHEN, H. C.**, Sequel to "Reciprocity relations in a compressible plasma," 20: 44902
**CHEN, H. H. C.**, Lossy, compressible, magneto-ionic media: formulation and equation decoupling, 20: 44901
**CHEN, Joseph C. Y.**, Interpretation of the cross section for vibrational excitation of molecules by electrons, 20: 44125
**CHEN, T. W.**, Role of causality in quantum field theory and the dynamical postulate, 20: 44317
**CHENARD, J.-Cl.**, Renal phlebography by selective angiography using ultra fluid lipiodol emulsion, 20: 43024
**CHENG, Ch'ang Ch'un**, Kinetics of isotope exchange between gaseous H and H dissolved in Pd, 20: 43236
**CHENG, D. K.**, Lossy, compressible, magneto-ionic media: formulation and equation decoupling, 20: 44901
**CHENG, D. K.**, Sequel to "Reciprocity relations in a compressible plasma," 20: 44902
**CHENG, H.**, Solvable example of Regge poles at zero energy, 20: 44344
**CHENG, Heng-shou**, Polarography and zone electrophoresis of uranyl-L-methionine complexes, 20: 43229
**CHERIGIE, E.**, Renal phlebography by selective angiography using ultra fluid lipiodol emulsion, 20: 43024
**CHERKASHIN, E. E.**, Ternary chemical compounds Ni–Ti–Nb system, 20: 43971
**CHERNENKO, G. T.**, Mechanism of antiradiation action by mercamine, 20: 43003
**CHERNIKOV, N. A.**, Solution of two plane wave scattering problem in nonlinear scalar field theory of the Born-Infeld type, 20: 44399
**CHERNOVA, L. I.**, Inelastic p-p interactions at 2.26 Bev, 20: 44189
**CHERNYAVSKII, M. M.**, New method of investigating the mechanism of nuclear interactions, 20: 44192
**CHERNYAVSKII, M. M.**, Quasi-nucleon interactions between 24 Bev/c protons and nuclei of a photographic emulsion in a strong magnetic field, 20: 44280
**CHERNYI, V. G.**, Niobium: metal of the space age, 20: 43817 (JPRS-36718)
**CHERVINSKAYA, L. S.**, Beta spectra of RaD, 20: 44831
**CHESHKOV, A. A.**, Elastic ed scattering and violation of CP invariance, 20: 44279
**CHEVALIER, P.**, Immunity in CBA mouse grafted with sarcoma J, 20: 42890
**CHEVALLIER, P.**, Transition between rotational bands in $^{16}$O, 20: 44776
**CHEW, H.**, Analytic expression for a class of Green's functions, 20: 44368
**CHIAVASSA, E.**, Neutron (14 Mev) studies on Cl, 20: 44746
**CHIEN, C. S.**, Analytical calculation of FFAG operating points and orbits, 20: 44042 (MURA-719)
**CHIFFELLE, Thomas L.**, Pathology of direct air-blast injury, 20: 42710 (TID-23348)
**CHIGVINADZE, D. G.**, Destruction of thin film superconductivity by current pulses, 20: 44511
**CHIKOVA, N. P.**, Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)
**CHIKOVANI, G.**, Structure within the R(1675) boson and possible structure within the A$_2$(1290), 20: 44245
**CHILASHVILI, O. A.**, Polarization of antimony, yttrium, and copper nuclei in iron, 20: 44824
**CHILTON, A. B.**, Comparison of theory and experiment for shielding by structure against fallout, 20: 43568 (AD-636787)
**CHILTON, Arthur B.**, Aperture and ceiling-shine effects in fallout shielding technology, 20: 43526
**CHIN, J.**, Structure and properties of pyrolytic carbons prepared in a fluidized bed between 1900 and 2400°C, 20: 43930
**CHING, Han-wen**, Analysis of the $^{12}$C(d,$\alpha_0$)$^{10}$B reaction, 20: 44826
**CHINOY, A. R.**, Studies on Cs sorption properties of some Indian vermiculites, 20: 43130
**CHIRAKADZE, G. G.**, Radiolysis of dodecyl mercaptan, 20: 43345
**CHITTENDEN, W. A.**, Approaching nuclear power, 20: 45182

**CHIU, Hong-Yee,** Symmetry between particle and antiparticle populations in the universe, 20: 44097
**CHKHEIDZE, I. I.,** Formation of radicals in the radiolysis of solid organic compounds. IV., 20: 43330
**CHLEBOVSKY, Ondrej,** Chromosome aberrations: increased incidence in bone marrow of irradiated rats, 20: 42951
**CHOHAN, V. S.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458
**CHOPPIN, Gregory R.,** Complexes of trivalent lanthanide ions. III., 20: 43215
**CHOUGHULEY, Ahmed S. U.,** Formation of biologically important monomers using radiations. I., 20: 42726
**CHOURAQUI, M.,** Origin of primary H atom yield in radiolysis of aqueous solutions, 20: 43351
**CHOUROULINKOV, I.,** Development of pulmonary adenomas in mice after treatment of urethane associated with x rays, 20: 42891
**CHOUROULINKOV, I.,** Histogenesis of thymic lymphomas induced by whole body x irradiation in mice, 20: 42892
**CHOW, J. G. Y.,** Effect of interstitial impurities on radiation hardening and embrittlement in iron, 20: 44001
**CHOWDHARY, S. Y.,** Preparation of $^{51}$Cr of high specific activity for medical use, 20: 43401
**CHRISTENSEN, P. R.,** Nonexistence of the 5.51 Mev and 6.10 Mev levels in $^{13}$C, 20: 44775
**CHRISTIANSEN, J.,** Scattering of polarized neutrons by $\alpha$ particles, 20: 44732
**CHRISTIE, G. L.,** Background radiation in the Roorkee area, 20: 43533
**CHU, C. K.,** Structure of Alfven shocks, 20: 44414
**CHU, Cheng Kang,** de Haas-Van Alphen effect in Sb at ultralow temperatures, 20: 44569
**CHU, Yung-ch'in,** Measurement of inelastic scattering cross section of Al by 2.52-Bev neutron, 20: 44828
**CHUBURKOV, Yu. T.,** Chemical properties of element 104, 20: 43192
**CHUDAREV, L. F.,** Investigation of some properties of niobium alloys, 20: 43940
**CHUISTOV, K. V.,** Incipient decomposition stages of supersaturated Co–Ta and Co–Nb solid solutions, 20: 43938
**CHUKHLANTSEV, V. G.,** Preparation and properties of sodium zirconodisilicate $Na_2ZrSi_2O_7$, 20: 43220
**CHUKHLOVIN, B. A.,** Detection of C- and $C_x$-reactive protein in irradiated blood serum, 20: 42876
**CHUKICHEV, M. V.,** Use of semiconductor counters of type p-l-n for study of nuclear reactions, 20: 43741
**CHUNG, Shu Urk,** Multi-pion final states from $\pi^-$p interactions at 3.2 and 4.2 Bev/c, 20: 44178 (UCRL-16881)
**CHUPRUNOV, D. L.,** Determination of depth of barrier window in N-I-P structure, 20: 43742
**CHUPRUNOV, D. L.,** Scintillation spectrometer for simultaneous investigation of competing nuclear reactions, 20: 43681
**CHWASZCZEWSKA, Janina,** Semiconductor system for charged particles identification, 20: 43717
**CHYLINSKI, Z.,** Nature of the Lorentz invariants, 20: 44482
**CIOCCO, Antonio,** Mortality, 1950–64, and disease and survivorship, 1958–64, 20: 42697 (ABCC-18-65)
**CIORA, Letitia,** Analysis of Cu sulfate solutions by the $\beta$ radiation reflection method, 20: 43142
**CIRELLI, R.,** Nonrelativistic nucleon-nucleon potential from S-matrix theory. II., 20: 44209
**CIZERON, G.,** Themal expansion of $\alpha$ Zr, 20: 43956
**CLAESON, T.,** Observations of gapless superconductivity induced by metallic contact, 20: 44565
**CLAIBORNE, H. C.,** Heating in infinite cylinders by uniform gamma sources, 20: 45050 (ORNL-TM-1260)
**CLARE, Ernest,** Improvements in or relating to mechanical handling equipment, 20: 43474
**CLARK, D. R.,** Analysis and simulation of the Enrico Fermi Power Plant, 20: 45168
**CLARK, F. H.,** Importance sampling devices for selecting track lengths and directions after scatter in 05R, 20: 44588 (ORNL-TM-1484)
**CLARK, G. Wayne,** Single-crystal growth of cerium dioxide from lithium ditungstate solvent, 20: 43818
**CLAUS, H.,** X-ray diffraction study of atomic ordering in two sigma phases, 20: 43890 (COO-1198-385)
**CLAUSS, A.,** Radiochemical determination of chlorides dissolved in water, 20: 43063 (EUR-2990.f)
**CLAUSS, A.,** Radiochemical determination of oxygen dissolved in water, 20: 43064 (EUR-2991.f)
**CLAXTON, T. A.,** General correlation of E.S.R. data for F-centers, 20: 43350
**CLAYTON, G. W.,** Energy transportation costs and their effect on the market for nuclear power in Canada, 20: 45177
**CLEAVER, J. E.,** Photoreactivation: radiation repair mechanism absent from mammalian cells, 20: 42869
**CLELAND, J. W.,** Production of disordered regions in germanium by electron irradiation, 20: 45009
**CLEMENT, G.,** Nonuniqueness of N/D solutions for singular potentials, 20: 44347
**CLEMENT, Joseph D.,** Local tissue dose from insoluble particles of $^{90}$Sr, 20: 43631
**CLEMENTI, T.,** Clinical and radiotherapeutical investigation of metastases and cutaneous reappearances of neoplasia in female organs, 20: 43039
**CLEVE, U.,** Complete installation of the AVR Reactor, 20: 45133
**CLEVE, U.,** Startup and operation testing (AVR), 20: 45145
**CLINARD, F. W.,** Effects of 2 at.% rare-earth additions on $\gamma \rightleftarrows \alpha$ transformation of Ce, 20: 45011
**CLINARD, O. J.,** Effect of radiation on ethylene-alkyl acrylate copolymers, 20: 43376
**CLINE, D.,** Backward $\pi^+$p elastic scattering from a direct channel $\Delta_\Delta$ resonance model, 20: 44236
**CLINE, D.,** Studies of the $^{12}$C($^3$He,$^3$He)$^{12}$C and $^{12}$C($^3$He,$\alpha_0$)$^{11}$C reactions, 20: 44728
**CLINE, J. E.,** Prog. rpt. on gamma-ray spectrometry of neutron-deficient isotopes, annual, 1965, 20: 44634 (IDO-17188)
**CLOSE, K. J.,** Entrapment in tungsten of helium positive ions of kinetic energies in the range 60 ev to 1 kev, 20: 44118
**CLOUD, R. L.,** Stresses at nozzles in spherical shells loaded with pressure, moment or thrust, 20: 43467 (TID-23343)
**CNARE, Eugene C.,** Magnetic flux compression by magnetically imploded metallic foils, 20: 44031
**CNOPS, A. M.,** Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230
**COCHE, A.,** Charge collection time of lithium-compensated silicon radiation detectors, 20: 43703
**COCHRAN, J. F.,** Superconducting transition and critical field of pure gallium single crystals, 20: 44545
**COCKE, C. L.,** Nonexistence of the 5.51 Mev and 6.10 Mev levels in $^{13}$C, 20: 44775
**COENDERS, W. J.,** Associated particle method for the D(d,n)$^3$He reaction, 20: 44813
**COET, P.,** High-voltage performances of electrostatic separators, 20: 44045 (NP-tr-1419)
**COFFEY, H. T.,** Radiation-induced peak effect in superconducting Nb–Zr, 20: 44505
**COFFIN, C. T.,** $\pi^+$p Elastic differential cross sections from 2.3 to 4.0 Bev/c, 20: 44248
**COFIELD, R. E.,** Falling drop density analysis for relative concentrations of H and D in lithium deuteride, 20: 43089 (Y-1175(Del.))
**COHEN, J.,** Versatile high pressure Moessbauer apparatus, 20: 43732
**COHEN, Martin J.,** Bone density measurement by means of radioisotopic source photon attenuation, 20: 43049
**COHEN, Montague,** Organization of clinical dosimetry. II., 20: 43021
**COHEN, Morton H.,** Reduction and hydrofluorination of U concentrates by fluid bed techniques, 20: 43200
**COHEN, O. P.,** Comparison of neutron moderation and gravimetric sampling for soil-moisture determination, 20: 43094
**COHEN, Roger W.,** Enhancement of superconductivity in metal films, 20: 44552
**COIGNET, G.,** Measurement of the parameters D and R′ in proton-deuteron triple elastic scattering, 20: 44233
**COIN, L.,** Importance of mud and suspended matter in transport and elimination of radionuclides contained in surface waters, 20: 43544
**COLE, J.,** Search for a baryon of positive strangeness, 20: 44195
**COLE, K. D.,** Magnetic storms and associated phenomena, 20: 44477
**COLE, R. K.,** Effect of $Z = 28$ shell closure on proton total reaction cross sections, 20: 44662 (USC-136-111)
**COLE, T. E.,** Oak Ridge High Flux Isotope Reactor, design and initial operation, 20: 45205 (ORNL-P-2491)
**COLELLA, R.,** Device for x-ray intensity measurements on samples undergoing irradiation, 20: 43646
**COLEMAN, C. F.,** Interface and transferring species in amine extraction of uranium, 20: 43424 (ORNL-P-2359)
**COLEMAN, C. F.,** Mass action and non-ideality in extraction by amine sulfate, 20: 43423 (ORNL-P-2354)
**COLEMAN, George H.,** Radiochemistry of Pu, 20: 43076 (NAS-NS-3058)
**COLI, M.,** Dynamic behavior of tunnel diode monostable circuits, 20: 43649
**COLL, J. A.,** Electron microscopy of beta-uranium, 20: 43955
**COLLINS, E. R.,** Measurement of the variation of the ratio of fission to absorption in $^{235}$U between 1 and 100 ev incident neutron energy, 20: 44648 (NRDC-117)
**COLLINS, W. T.,** Gravimetric gas flow standard, 20: 43633 (K-1632(Pt.1))
**COLLINSON, A. J. L.,** Relationships between light output and energy resolution in Tl activated sodium iodide crystals, 20: 43704
**COLVETT, Robert D.,** Skyshine considerations for accelerator shielding design, 20: 44057
**COLVIN, D. W.,** Revision of the Harwell $^{240}$Pu source strength and $\bar{\nu}$ for $^{235}$U and $^{252}$Cf, 20: 44594

**COMBATTI, Nicholas C.,** Factors influencing variation in RBE in irradiation of maize seeds, 20: 42843 (BNL-10358)

**COMFORT, J. R.,** Energy loss and straggling of alpha particles in metal foils, 20: 44144

**COMMANAY, Louis,** Effect of whole body irradiation by x rays on thyroid metabolism of rat, 20: 43029

**COMMINS, Eugene D.,** Large aperture, high efficiency ion detector, 20: 43735

**CONGDEON, C. C.,** Prog. rpt. on $O_2$ consumption, $CO_2$ accumulation, and $N_2$ balance in mouse radiation chimeras, 1962–65, 20: 42854 (TID-23127)

**CONTE, F.,** Structures in the 4 $\pi$ mass system in the reaction $\pi^- p \to p\pi^-\pi^+\pi^-\pi^0$ at 11 Bev/c, 20: 44241

**CONTE, Frank P.,** Effects of radiation on osmoregulation in fish Oncorhynchus kisutch, 20: 42885

**CONWAY, John Edward Jr.,** Separation of Nb and Ta, 20: 43170 (IS-T-107)

**COOK, A. M.,** Direct and indirect effects of radiation: their relation to growth, 20: 43771

**COOKSON, J. A.,** Search for the $^{3}$He(p,n)3p reaction, 20: 44786

**COOPER, J. A.,** Lead isotopes and volcanic magmas, 20: 43521

**COPELAND, M. I.,** Electrical resistivity of fused hafnium carbide alloys at elevated temperature, 20: 43917 (USBM-RC-1113)

**COPLEY, L. A.,** Cross sections and resonance integrals for the neutron activation of $^{103}$Rh, 20: 44689

**CORCIOVEI, A.,** Anisotropy of the Debye-Waller factor for the Moessbauer effect in thin films, 20: 44137

**CORDELL, Thomas L.,** Effect of hydrostatic pressure (14 kbar) on the ultimate compressive strength of various sintered materials, 20: 43909 (SC-DC-66-1888)

**CORDISCHI, D.,** Polymerization of tetrafluorethylene oxide, 20: 43301

**CORELLI, J. C.,** Production of disordered regions in germanium by electron irradiation, 20: 45009

**CORENZWIT, E.,** Many more superconducting bismuth phases, 20: 44554

**CORINALDESI, A.,** Conventional and high energy radiotherapy in treatment of malignant tumors of rhino-pharynx, 20: 43042

**CORLL, James A.,** Effect of hydrostatic pressure (14 kbar) on the ultimate compressive strength of various sintered materials, 20: 43909 (SC-DC-66-1888)

**COSPER, John H.,** Critical organ exposure during fluoroscopy with analysis of contributing parameters, 20: 43050

**COSPER, S. W.,** Calcium-37 and the mass 37 $T = 3/2$ quartet, 20: 44659 (UCRL-16990)

**COSTA, G.,** Effects of x rays on proliferative activity of stem cells derived in culture from lymphocytes of human blood, 20: 42872

**COTTIER, H.,** Hematopoietic stem cell function of lymphoid cells of blood, 20: 42784

**COURBON, J.,** Prestressed concrete containments in nuclear power plants, 20: 45127 (ORNL-tr-1228)

**COUTERNE, J. C.,** Thermal expansion of $\alpha$ Zr, 20: 43956

**COX, Samson A.,** Measurement of the $^{6}$Li(n,$\alpha$) and $^{10}$B(n,$\alpha$) cross sections by the shell transmission method, 20: 44617 (CONF-660303, pp 701-12)

**COYLE, Charles F.,** Contribution to thermochemistry of beryllium fluoride: application of rotating-bomb calorimeter, 20: 43269

**COYLE, Francis T.,** Determination of Fe in Ta and Nb by atomic absorption spectrophotometry, 20: 43162

**COYNE, J. J.,** Classification of the $Y_1^*(1765)$ and $Y_0^*(1520)$ resonances in the 1134 representation of SU(6), 20: 44258

**CRAM, Leighton Scott,** Transition radiation and low-energy bramsstrahlung from silver and aluminum foils bombarded by grazing-incidence electrons, 20: 44111 (ORNL-TM-1571)

**CRAVEN, W. E.,** Rare earth graphite intercalation compounds, 20: 44999

**CRAWFORD, F. W.,** Pulsed transmission and ringing phenomena in a warm magnetoplasma, 20: 44944

**CRAWFORD, Oakley H.,** Reaction dynamics in crossed molecular beams, 20: 44109 (CALT-532-3)

**CREAGAN, R. J.,** Nuclear power plant reliability, 20: 45181

**CRESCENTI, E.,** Shell-model states of the oxygen isotopes, 20: 44749

Crespo, G. Gomez
  *see Gomez Crespo, G.*

**CRICHTON, J. H.,** Phase-shift ambiguities for spin-independent scattering, 20: 44337

**CRIJNS, F.,** Decay angular distributions of resonances in two-body reactions produced by 8 Bev/c positive pions on protons, 20: 44226

**CROFT, W. J.,** Optical phenomenon in $LiNbO_3$ single crystals, 20: 43950

**CROLL, Millard N.,** Symposium on advances in nuclear medicine, 3/65, 20: 43051

**CRONENBERGER, D.,** Measurement of the parameters D and R′ in proton-deuteron triple elastic scattering, 20: 44233

**CRONKITE, Eugene P.,** Properties of hemopoietic stem cell, 20: 42705 (BNL-10405)

**CROSBY, E. H.,** Use of lithium fluoride dosimeters for in vivo measurement of transmission through bone and lung, 20: 43747

**CROSBY, William H.,** Regeneration of locally irradiated bone marrow. I., 20: 42871

**CROSS, Ford A.,** Prog. rpt. on element and energy transfer in lower trophic levels in marine environment, 4/63–3/66, 20: 42731 (RLO-1751-2)

**CROUSE, R. S.,** Effect of curing stresses in epoxy resins, 20: 43906 (ORNL-P-2361)

**CROUZET, Claude,** Radiation cross-linking of polyoxyethyleneglycol in aerated aqueous solution, 20: 43375

**CROWELL, Julian,** Ladder corrections to the static random-phase-approximation dielectric constant and to positron annihilation in metals, 20: 44247

**CROZIER, W. D.,** Measurements of $^{220}$Rn (thoron) in the atmosphere below 50 cm, 20: 43543

**CROZON, M.,** Production of isospin 1 resonances in the reaction P + P = D + (missing mass), 20: 44243

**CRYSTAL, Maxwell M.,** First efficient chemosterilants against screw-worm flies, 20: 42724

**CUEER, P.,** Discrimination of nuclear tracks in ionographic emulsion by electron microscopy, 20: 43731

**CUGINI, A.,** Localization of radiferous sources for dosage calculation in interstitial radium therapy. I., 20: 43616

**CULHANE, J. L.,** High gain saturation effects in proportional counters, 20: 43736

**CULLEN, A. L.,** Ray-theory interpretation of reflection of radio waves by a linearly graded plasma, 20: 44898

**CULLEN, G. W.,** Enhancement of superconductivity in metal films, 20: 44552

**CULLIFORD, E. R.,** Revision of the Harwell $^{240}$Pu source strength and $\bar{\nu}$ for $^{235}$U and $^{252}$Cf, 20: 44594

**CUMMINGS, W. D.,** Asymmetric ring currents, 20: 44444

**CUMO, M.,** Subcooled nucleate boiling with organic coolants, 20: 43486

**CUNNOLD, D. M.,** Magnetic field variations in temperate zone sporadic-E layers, 20: 44468

**CUPERMAN, S.,** Nonlinear effects of beam-plasma instability in partially ionized gases, 20: 44939

**CURRIE, Robert G.,** Geomagnetic spectrum: 40 days to 5.5 years, 20: 44451

**CURTIS, M. H.,** Ammonium diuranate filterability, 20: 43428 (RL-SEP-924)

**CURTIS, M. H.,** Continuous uranium peroxide precipitation, 20: 43414 (ISO-207)

**CUTLER, Ivan B.,** Prog. rpt. on recrystallization and sintering of oxides, 9/65–8/66, 20: 43813 (COO-1122-3)

**CVELBAR, F.,** Spectrometer for 14 Mev neutron capture spectroscopy, 20: 43708

**CVETANOVIC, R. J.,** Intersystem crossing of electronically excited dideuteroethylene molecules formed in benzene photosensitization, 20: 43197

**CZYZ, Wieslaw,** Transverse sum rule for electrons scattered inelastically with large momentum transfers from light nuclei, 20: 44636 (INP-479/PL)

# D

**DABBS, J. W. T.,** Feasibility of experiments using underground nuclear explosions, 20: 43460 (ORNL-P-2389)

**DABROWSKI, Cyryl,** HELENA codes for material buckling determination in subcritical assemblies, 20: 45073 (INR-659/IXA/RP)

**D'ADDABBO, Angelo,** Mucoprotein urine in radiation injuries. I., 20: 42960

**DAGET, J.,** Insect infection of African dried or smoked fish and the possibility of its control by irradiation, 20: 43777

**DAIBER, J. W.,** Estimates of nonequilibrium ionization phenomena in the inviscid Apollo plasma sheath, 20: 44861 (NASA-CR-596)

**DAIEV, C.,** Photometric Ce determination in cast Fe and alloyed steel with help of tetron, 20: 43143

**DALINENKO, N. K.,** Photomultiplier sensitive in ultraviolet spectral region, 20: 43727

**DALY, N. R.,** Fast counting with the scintillation detector, 20: 43746

**D'AMATO, F.,** Chromatid and chromosome aberrations in irradiated dry seeds of Vicia faba, 20: 42920

**DAMESHEK, W.,** X-radiation and alkylating agents as trigger mechanisms in autoimmune complications of malignant lymphoproliferative disease, 20: 43027

**DAMON, Paul E.,** Argon-40 in cogenetic feldspar-mica mineral assemblages, 20: 43503 (COO-689-60, App. A-3)

**DAMON, Paul E.,** Cenozoic argon ages on metamorphic rocks from the Basin and Range Province, 20: 43501 (COO-689-60, App. A-1)

**DAMON, Paul E.,** Prog. rpt. on correlation and chronology of ore deposits and volcanic rocks, annual, 6/65–7/66, 20: 43500 (COO-689-60)

**DAMON, Paul E.,** Radioactive dating of Quaternary tephra, 20: 43506 (COO-689-60, App. A-6)

**DAMON, Paul E.,** Relationship between terrestrial factors and climate, 20: 43505 (COO-689-60, App. A-5)

**DANBARA, Hiroshi,** Transitions of $^{90}$Sr and $^{137}$Cs concentrations in milk. II., 20: 43520

**DANFORD, M. D.,** X-ray diffraction data on liquid water in temperature range 4 to 200°C, 20: 43180 (ORNL-3997)
**DANG, G. Do,** Quadrupole moment of the first excited state of spherical nuclei, 20: 44812
**DANIEL, I. M.,** Prog. rpt. on stress wave interaction in photoviscoelastic plates, 10/63–2/65, 20: 43495 (AD-628806)
**DANIELESCU, G.,** Reactivation at low temperature of Sabin polyviruses inactivated by x-rays, 20: 42966
**DANIELS, E. A.,** Desorption of tracer iodide ions adsorbed on silver, 20: 43250
**DANIELS, J. M.,** Intermediate-state reorientation of oriented nuclei, 20: 44688
**DANIELS, Malcolm,** Pulse radiolysis of aqueous nitrate system, 20: 43321
**DANIELS, W. R.,** Beta decay of cerium isotopes far to the neutron-rich side stability, 20: 43419 (LA-DC-7869)
**DANILIN, L. D.,** Radioactive source of soft x radiation for physical investigations, technology, and medicine, 20: 43384
**DANILOV, A. D.,** Variation in the ionic composition of the atmosphere at altitudes of 100 to 200 km, 20: 44462
**DANNER, J. C.,** Temperature dependence of fluorine and $^{13}$C hyperfine interactions of hexakis(trifluoromethyl)benzene anion, 20: 43225
**DANOS, M.,** Stretch scheme, a microscopic description of rotations in nuclei, 20: 44810
**DANYSZ, Andrzej,** Reaction of rat intestines to parasympathomimetic substances during radiation syndrome, 20: 42964
**DA PROVIDENCIA, J.,** Random-phase approximation ground state in agreement with the conservation laws, 20: 44766
**DARENSKAYA, N. G.,** General radiation sensitivity of organisms, 20: 42849 (NP-16258)
**DARRALL, K. G.,** Installation of a 14 Mev neutron generator, 20: 44596
**DARRIULAT, P.,** Elastic scattering of polarized deuterons from $^{4}$He between 18 and 22 Mev, 20: 44750
**DAS, M. Sankar,** Determination of Rb and Cs by neutron activation, 20: 43133
**DAS, M. Sankar,** Separation of Nb from Ta by solvent extraction using TBP, 20: 43131
**DAS, T.,** Bounds on the ratio $f_-/f_+$ in $K_{l3}$ decays, 20: 44260
**DASANNACHARYA, B. A.,** Neutron scattering from gaseous methane and ammonia, 20: 44599
**DAS GUPTA, Sharda,** Modification of cotton fabrics by graft polymerization 20: 43299
**DATZEFF, A.,** Wave and corpuscular properties of the photon, 20: 44184
**DAUELSBERG, L. B.,** Thermal conductivity of ZTA graphite, 20: 43896 (LA-DC-8163)
**DAUTREPPE, D.,** Alloys under irradiation, 20: 44025
**DAVEY, William G.,** Critical evaluation of fast fission cross sections, 20: 44622 (CONF-660303, pp 796-808)
**DAVIDSON, M. G.,** Note on parity and the asymmetric top model, 20: 44781
**DAVIES, A. R.,** Measurements and calculations of the Doppler effect on the reactions $^{238}$U(n,$\gamma$), $^{235}$U(n,f) and $^{239}$Pu(n,f) with neutrons in the energy range 0-25 kev, 20: 44627 (CONF-660303, pp 933-8)
**DAVIES, K. T. R.,** Hartree-Fock calculations with a density-dependent interaction, 20: 44785
**DAVIES, N. F.,** Developmental irradiation test of SNAP-8 electrical components (HF-8), 20: 45194 (NAA-SR-11924)
**DAVIS, C. M. Jr.,** Two-state theory of the structure of $D_2O$, 20: 44032
**DAVIS, S. K.,** Compilation, evaluation, and reduction of neutron differential scattering data, 20: 44578 (CONF-660303, pp 335-53)
**DAVITASHVILI, T. Sh.,** Local centers in irradiated ionic crystals, 20: 43306
**DAVYDOV, B. I.,** Problem of using radioprotective pharmacological agents under spaceflight conditions, 20: 43004
**DAVYDOV, B. I.,** Radiation protection during the flight in satellites "Voskhod I" and "Voskhod II", 20: 44990
**DAVYDOV, B. I.,** Radiobiological effects in animals after preliminary action of acceleration, 20: 42985
**DAVYDOV, V. V.,** Biological studies carried out in satellites, 20: 42912
**DAWSON, John W.,** Data handling and control circuit for liquid scintillation spectrometers, 20: 43749
**DAWSON, John W.,** Liquid scintillation spectrometer detection chamber, 20: 43748
**DAY, Frank,** Bone density measurement by means of radioisotopic source photon attenuation, 20: 43049
**DAYANIDHI, P. K.,** Neutron scattering from gaseous methane and ammonia, 20: 44599
**DEAN, C. J.,** Site of action of cysteamine in irradiated bacteria, 20: 42802
**DEAN, G.,** Sintering of $(U,Pu)O_2$ pellets, 20: 43865 (EURFNR-96F)
**DEAN, L. A.,** Fluidized bed recovery of F in manufacture of $UF_6$, 20: 43199
**DEAN, L. A.,** Mechanically agitated fluid beds applied to hydrofluorination of UO powders, 20: 43198
**DEARDORFF, D. K.,** Electrical resistivity of fused hafnium carbide alloys at elevated temperature, 20: 43917 (USBM-RC-1113)
**DE BAENST, P.,** Current commutation relations and meson photoproduction near threshold, 20: 44211
**DEBETS, P. C.,** Structure of $\beta$–$UO_3$, 20: 43921
**DE BOER, P. C. T.,** Langmuir probe method for plasma having small amplitude oscillations, 20: 44918
**DEBRUNNER, P.,** Versatile high pressure Moessbauer apparatus, 20: 43732
**DE BRUYN OUBOTER, R.,** Oscillations in voltage between two weakly connected current-carrying superconductors, 20: 44561
**DECKER, Christian,** Radiation cross-linking of polyoxyethyleneglycol in aerated aqueous solution, 20: 43375
**DECKER, J. F.,** Energy loss and straggling of alpha particles in metal foils, 20: 44144
**DECKER, John A. Jr.,** Low-frequency oscillations in a thermal cesium plasma, 20: 44906
**DEDGAONKAR, V. G.,** Isotope exchange reaction between iodide and iodate ions studied by paper chromatography. II., 20: 43248
**DEDGAONKAR, V. G.,** Use of charged plates in the (n,$\gamma$) radiolysis of bromo and iodo compounds. V., 20: 43367
**DEEVEY, Edward S.,** Radiocarbon. 8., 20: 43560
**DE FOREST, F. G.,** Differential cross sections of $^{16}$O(d,p)$^{17}$O, 20: 44835
**DE FOREST, T. Jr.,** Electron scattering and nuclear structure, 20: 44679
**DE GEE, A. W. J.,** Wear in a nuclear reactor of novel design, 20: 43843
**DE GENNES, P. G.,** Coupling between ferromagnets through a superconducting layer, 20: 45021
**DEGTYAREV, Yu. G.,** Fast neutron spectrometer using Si surface-barrier detectors and Li$^{6}$F, 20: 43718
**DE JUREN, J. A.,** Cold neutron effects in graphite diffusion measurements, 20: 44585 (NAA-SR-Memo-11866)
**DEKA, G. C.,** Observation of $^{8}$He among "hammer tracks" in nuclear emulsion, 20: 44747
**DEKA, K. C.,** Observation of $^{8}$He among "hammer tracks" in nuclear emulsion, 20: 44747
**DELBOURGO, R.,** Multiple field relations, 20: 44363
**DELLA ROSA, R. J.,** Strontium-90 in beagle hair, 20: 42780
**DELLIEHAUSEN, C.,** Preparation and x-ray investigation of higher uranium nitrides, 20: 43191
**DELLOUE, Jean,** Optical path variation of signals generated by a long-wave emitter and propagated in the whistling mode, 20: 44429
**DELLOUE, Jean,** Use of transmission curves to interpret backscattering echos, 20: 44428
**DELONE, N. L.,** Biological studies carried out in satellites, 20: 42912
**DELONE, N. L.,** Effect of Vostok-5 and Vostok-6 flights on primary rootlet chromosomes of plant seedlings, 20: 42909
**DELSANTO, P. P.,** Isotopic-spin selection rules and mechanism of reactions involving virtual photons in light nuclei, 20: 44744
**DEL VAL COB, M.,** Utilization of radioactive isotopes in construction problems. II., 20: 43762
**DELYAGIN, N. N.,** Magnetic hyperfine structure of $^{155}$Gd levels in Gd and $GdAl_2$, 20: 44832
de Medeiros Neto, Geraldo A.
    *see Neto, Geraldo A. de Medeiros*
**DEMENTEV, V. S.,** Distribution of Th isotopes between the particles of various degree of dispersion in natural waters, 20: 43535
**DEMIN, Yu. S.,** Analysis of initial radiation effects on chromosomes, 20: 42936
**DEMIN, Yu. S.,** Effect of space-flight factors on hereditary structures of mammals, 20: 42986
**DEMINT, Robert J.,** Radiation-induced interaction of acrylonitrile with cyanoethylated cotton, 20: 43348
**DEMINT, Robert J.,** Radiation-induced interaction of styrene with cotton, 20: 43349
**DEM'YANOV, A. V.,** Diffusion of nuclear reaction recoil products in different materials, 20: 43073 (JINR-P-2804)
**DE NARDI, Joseph M.,** Medical management of Be workers, 20: 42756
**DENISON, A. B.,** Nuclear magnetic relaxation measurements of $^{17}$O in enriched $H_2{}^{17}O$ and $D_2{}^{17}O$, 20: 43171 (LA-DC-7394(Rev.))
**DENNIS, Norman M.,** Effects of $\gamma$-ray irradiation of stored-product insects, 20: 42904
**DE NOVION, Charles,** Neutron diffraction study of $U_2C_3$, 20: 45002
**DEONIGI, D. E.,** Comparative costs of oxide and fuel elements, 20: 43849 (BNWL-273(Vol.1 and App.))
**DEONIGI, D. E.,** Effect on fuel element costs when certain reference values are varied, 20: 45095 (BNWL-273(Vol.3))
**DEONIGI, D. E.,** Formation of transuranium isotopes in power reactors, 20: 43800 (BNWL-140(Rev.1))
**DEONIGI, D. E.,** Possible optimum use of thorium and uranium employing crossed-progeny fuel cycles, 20: 45096 (BNWL-289)
**DE PAOLI, T.,** Albumin macroaggregates labeled with $^{99m}$Tc, 20: 43390
**DEREVSHCHIKOV, V. A.,** Spectroscopic investigation of a pulsed low-voltage, discharge plasma in a vacuum, 20: 44959
**DERING, W.,** Special devices of the AVR Reactor. Steam generator,

20: 45137

**DE RUIG, W. G.**, Decontamination of milk contaminated with radioactive substances, 20: 43537

**DERYABINA, M. A.**, Spectroscopic investigation of a pulsed low-voltage, discharge plasma in a vacuum, 20: 44959

**DESAI, C. N.**, Preparation of special radioisotope labeled compounds at Trombay, 20: 43397

**DESAI, H. B.**, Separation of Nb from Ta by solvent extraction using TBP, 20: 43131

**DESAI, K. K.**, Isotopic exchange of bromine between acetyl bromide and labeled bromides, 20: 43247

**DESALVO, A.**, Electrical resistivity study of recovery phenomena in cold-worked zirconium, 20: 43959

**DE SANTOS, M. Leal**, Estimation of the correlation energy between two paired electrons, 20: 44132

**DESER, S.**, Massive spin-two field, 20: 44295

**DE SERRES, Frederick J.**, Impaired complementation between nonallelic mutations in Neurospora, 20: 42926

**DE SILVA, N. N.**, Clostridium botulinum, type E, in relation to irradiation treatment of fresh fish, 20: 43779

**DETILLEUX, E.**, Requirements and problems of high activity waste management at the Eurochemic reprocessing plant, 20: 45232

**DETMER, J. E.**, Electronic data processing method assessment of potential off-site radiological effects, 20: 43609

**DETRAZ, C.**, Comparison of (d,t) and d,$^3$He) cross sections, 20: 44794

**DEUTSCHMAN, J. E.**, Determination of O and Na in Al and its alloys by radioactivation and $\gamma$-ray spectroscopy, 20: 43155

**DEUTSCHMANN, M.**, Decay angular distributions of resonances in two-body reactions produced by 8 Bev/c positive pions on protons, 20: 44226

**DEVARE, H. G.**, Directional correlation studies in $^{125}$Sn → $^{125}$Sb decay, 20: 44705

**DEVARE, H. G.**, Nuclear spectroscopic studies of $^{101}$Mo → $^{101}$Tc → $^{101}$Ru decay chain using chemically separated activities, 20: 44817

**DEVARE, S. H.**, Directional correlation studies in $^{125}$Sn → $^{125}$Sb decay, 20: 44705

**DE VILLIERS, Daphne B.**, Semiquantitative procedure for simultaneous spectrographic determination of elements in powder samples, 20: 43104

**DHARKAR, S. D.**, Radiation preservation of fruits and vegetables, 20: 43781

**DHUICQ, Daniel**, Towards the design of an objective using quadrupole lenses and corrected for aperture aberrations, 20: 44047

**DIACONESCU, A.**, Cold neutron scattering by liquid nitrogen, 20: 44598

**DIAMOND, J. J.**, Bibliography on high temperature chemistry and physics of materials in condensed state, 20: 43903 (NP-16238)

**DIAZ NOGUEIRA, Eduardo**, Technical and economic aspects of irradiated fuels, 20: 43435

**DIEHL, J.**, Decays of vacancy agglomerates in neutron-irradiated Ni, 20: 45038

**DIEHL, J.**, Strengthening mechanism in neutron-irradiated Cu single crystals. II., 20: 45032

**DIENST, W.**, Irradiation behavior of tempered Ni–Cr–Fe alloy, 20: 44013

**DIETRICH, W. C.**, Purification of concentrated lithium chloride solution, 20: 43092 (Y-1553)

**DIETZE, H.-D.**, Theory of inelastic neutron scattering of metallic electrons in one-electron approximation, 20: 44135

**DI GIUGNO, G.**, A measurement of the branching ratio $\omega \rightarrow$ neutrals/$\omega \rightarrow \pi^+ + \pi^- + \pi^0$, 20: 44176 (LNF-66/31)

**DIKMEN, N.**, $\pi^+$p Elastic differential cross sections from 2.3 to 4.0 Bev/c, 20: 44248

**DIMAKSYAN, A. M.**, Investigation of radiometer (RD-1C) efficiency for flow rate measurements, 20: 43662

**DIMAKSYAN, A. M.**, Use of neutron scattering method for measuring soil water content, 20: 43558

**DISCHLER, B.**, Classification and analysis of NMR spectra, 20: 44680

**DISDIER, D.**, Transition between rotational bands in $^{16}$O, 20: 44776

**DISTENFELD, Carl H.**, Skyshine considerations for accelerator shielding design, 20: 44057

**DITTMANN, P.**, Structures in the 4 $\pi$ mass system in the reaction $\pi^-p \rightarrow p\pi^-\pi^+\pi^-\pi^0$ at 11 Bev/c, 20: 44241

**DI VECCHIA, P.**, Note on double bremsstrahlung, 20: 44202

**DIXIT, R. M.**, Effect of reactor radiations on fluorescence spectrum of $RbUO_2(NO_3)_3$, 20: 43365

**DIXON, Bryan W.**, Neutron activation analysis of Ru in sea water, 20: 43086 (TID-23295, Sect. 3)

**DIXON, Frank J.**, Prog. rpt. on immune response and effect of radiation on this response, annual, 6/65–5/66, 20: 42855 (TID-23203)

**DMITRIEV, M. T.**, Importance of electron and ion recombinations during radiation oxidation of N, 20: 43354

**DNESTROVSKII, Yu. N.**, Plasma density spatial distribution measurements by means of multi-beam microwave probing, 20: 44857 (IAE-1153)

**DOBROSEL'SKAYA, N. P.**, Cracking of cumene over radioactive tricalcium phosphate catalyst, 20: 43391

**DOBROV, N. N.**, Radiation protection during the flight in satellites "Voskhod I" and "Voskhod II", 20: 44990

**DOBYCHIN, V. P.**, Use of neutron scattering method for measuring soil water content, 20: 43558

**DOBYNS, Brown M.**, Prog. rpt. on physiological function and histological changes in thyroid irradiated with $^{131}$I, annual, 6/65–6/66, 20: 42857 (TID-23228)

**DODGE, W. R.**, Measurement of the mean energy required to create an electron-hole pair in silicon between 6 and 77°K, 20: 45028

**DOERNER, R. C.**, Theoretical and experimental physics studies of tungsten based nuclear rockets, 20: 45199

**DOLYA, G. P.**, Neutron generator accelerator tubes made with epoxide compounds, 20: 44059

**DOMANSKII, A. N.**, Cooled photomultipliers of FEU-39 and FEU-46A types, 20: 43723

**DOMBEY, Norman**, Isospin properties of electromagnetic interactions, 20: 44371

**DOMEN, S. R.**, Measurement of the mean energy required to create an electron-hole pair in silicon between 6 and 77°K, 20: 45028

**DOMININGHAUS, Hans**, Application of plastics in nuclear engineering, 20: 43471

**DOMSA, A.**, Pressing and sintering properties of Mo powders, 20: 43867

**DOMSHLAK, M. P.**, General radiation sensitivity of organisms, 20: 42849 (NP-16258)

**DOMSHLAKA, M. P.**, Problems of general radiobiology, 20: 43625

**DONALD, R. A.**, Interactions K$^0$-p and S-wave kaon-nucleon scattering lengths, 20: 44244

**DONNER, M.**, Importance of mud and suspended matter in transport and elimination of radionuclides contained in surface waters, 20: 43544

**DORE, R.**, Physical and chemical cleanliness of surfaces in nuclear techniques and applications, 20: 43599

**DOROSH, M. M.**, Determination of oil–water interface based on delayed neutron detection, 20: 43553

**DOSE, V.**, Electron capture into the 2s-state of H in close H$^+$–He collisions, 20: 44138

**DOTE, Toshihiko**, Characteristics of cylindrical probe in low-density plasma stream, 20: 44919

**DOTSON, L. E.**, Purification, analysis and handling of Na and K, 20: 43083 (R-66SD3012)

**DOUDNEY, C. O.**, Photoreversal of uv light induced mutation, damage to nucleic acid formation in bacteria, 20: 42812

**DOWDEN, W. A.**, X-ray fluorescence analysis, 20: 43058 (AERE-Bib-136(Pt.2))

**DOWKER, J. S.**, Interactions of massless particles of arbitrary spin, 20: 44372

**DOWKER, Yih P.**, Interactions of massless particles of arbitrary spin, 20: 44372

**DOWNS, Angela M.**, Motion of cylindrical plasma sheets in a magnetic field, 20: 44415 (AD-628320)

**DOYON, D.**, Renal phlebography by selective angiography using ultra fluid lipiodol emulsion, 20: 43024

**DRACHMAN, Richard J.**, Positron annihilation in helium, 20: 44246

**DRAGONI, G.**, Investigation of radiosensitizer by measurement of uptake of $^{32}$P in irradiated tumors, 20: 42776

**DRAKE, David G.**, MHD flow in rectangular channel at high Hartmann number, 20: 44413

**DRALEY, J. E.**, Crevice-galvanic corrosion of aluminum, 20: 43824 (ANL-6236)

**DRAPER, James E.**, Beam steering with quadrupole and with rectangular box magnets, 20: 44065

**DRECHSEL, W.**, Physics of the AVR Reactor, 20: 45144

**DRECHSLER, W.**, X$^0$-photoproduction in the Regge-pole model, 20: 44204

**DREIZLER, R.**, Quadrupole moment of the first excited state of spherical nuclei, 20: 44812

**DREMIN, I. M.**, New method of investigating the mechanism of nuclear interactions, 20: 44192

**DREW, Robert T.**, Natural radiation dose to indigenous rodents on the Morro do Ferro, Brazil, 20: 43606

**DRICKAMER, H. G.**, Versatile high pressure Moessbauer apparatus, 20: 43732

**DUBAL, L.**, Structure within the R(1675) boson and possible structure within the $A_2$(1290), 20: 44245

**DUBOIS, Claude**, Electrostatic collection of Th A, 20: 43387

**DUBOIS, Emmanuel**, Electrostatic collection of Th A, 20: 43387

**DUBOVIK, V. M.**, Elastic ed scattering and violation of CP invariance, 20: 44279

**DUBROVSKII, V. B.**, Influence of neutron radiation on some properties of refractory concretes, 20: 44005

**DUDELZAK, B.**, Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 F$^{-2}$, 20: 44253

**DUFEY, J. P.**, Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230

**DULOCK, Victor A.**, Degeneracy of cyclotron motion, 20: 44913

**DUMAS**, Effect of alternate temperature variations on prestressing steels, 20: 43456 (ORNL-tr-1348)
**DUNFORD, C. L.**, Nonspherical optical model, 2-PLUS, for fast neutron cross sections, 20: 44645 (NAA-SR-11706)
**DUNFORD, Charles L.**, Compilation, evaluation, and production of nuclear data for reactor calculations, 20: 44583 (NAA-SR-11980(Vol. 1))
**DUNFORD, Charles L.**, Optical-model analysis of some recent tungsten cross-section measurements, 20: 44646 (NAA-SR-11973)
**DUNFORD, E.**, Interaction of solar corpuscular stream with geomagnetic field, 20: 44439
**DUNLAY, J. B.**, Prog. rpt. on vacuum foil-type insulation for radioisotope power systems, 5–7/66, 20: 43798 (ALO-3634-2)
**DUNN, E. L.**, Sodium mass transfer. XIV., 20: 43826 (GEAP-4830)
**DUNN, M. G.**, Estimates of nonequilibrium ionization phenomena in the inviscid Apollo plasma sheath, 20: 44861 (NASA-CR-596)
**DUPLAN, J. F.**, AKR leukemogenesis after x irradiation followed by restoration by allogenic fetal liver, 20: 42893
**DUPUY, Michel**, Self diffusion of Pu in the $\epsilon$ phase, 20: 43932
**DUPUY, P.**, Radiosensitization of yeasts by iodo-acetamide, 20: 42901
**DURAND-SMET, R.**, Neutronic values of Na-cooled fast reactors with SNEAK-2 assembly, 20: 45207 (EURFNR-76F)
**DUSHIN, L. A.**, Bremsstrahlung of a $\theta$-pinch plasma in the infrared spectral region, 20: 44984
**DUSHIN, L. A.**, Determination of the spatial density distribution of a plasma using microwave refraction, 20: 44982
**DUSHIN, L. A.**, Drift instability of plasma discharge with oscillating electrons, 20: 44863 (NP-16310)
**DUSHIN, L. A.**, Microwave refraction by a nonhomogeneous cylindrical plasma, 20: 44981
**DUSHIN, L. A.**, Studying a plasma by probing with microwaves, 20: 44983
**DUTTA, A. K.**, Lambda-binding energies of hypernuclei. I., 20: 44702
**DUTTA, A. K.**, Non-degenerate statistical approach to the binding energy of nuclei and of $\Lambda$-hypernuclei. II., 20: 44703
**DWORZECKA, Maria**, Dependence of the equilibrium density of nuclear matter on the neutron excess, 20: 44674
**DYACHENKO, P. P.**, Fission fragments for fission of $^{235}$U induced by thermal neutrons and 5, 6, and 7 Mev neutrons, 20: 44673 (LA-tr-66-36)
**DYAKONOV, M. I.**, Ion line splitting due to rotation of the ions in a magnetic field, 20: 44967
**DYER, K. F.**, Fitness and competitive ability in irradiated of Drosophila melanogaster, 20: 42922
**DYER, W. J.**, Gamma irradiation as means of extending storage life of haddock fillets, 20: 43770
**DYRING, Eric**, Latitude effect of the neutron multiplicity as detected by a shipborne neutron monitor, 20: 44423
**DYRING, Eric**, Multiplicity measurements on the Uppsala IGY-neutron monitor, 20: 44424
**DYRING, Eric**, Solar cycle variation in the attenuation length of the cosmic ray nucleon component, 20: 44425
**DZHAUGASHTIN, K. E.**, Hysteresis phenomena during the flow of a conducting gas in an MHD energy converter channel, 20: 44411
**DZHIBUTI, R. I.**, Energy spectra and angular distributions of nucleons in three-particle photodisintegration of the $^3$He nucleus, 20: 44711
**DZHIBUTI, R. I.**, Photodisintegration of the $^3$He and $^3$H nuclei, 20: 44823
**DZHOLOS, R. V.**, Calculation of nucleon-phonon interaction effects in a simple nuclear model, 20: 44638 (JINR-E-2772)

## E

**EARGLE, J. C. Jr.**, Recovery of $^{233}$U from irradiated thoria, 20: 43415 (ISO-SA-3(Rev.))
**EARLE, E. D.**, Neutron-capture $\gamma$-ray studies in $^{50}$Cr$(n,\gamma)^{51}$Cr, 20: 44693
**EASTERDAY, R. J.**, APT post processor for positioning machines, 20: 45238 (K-1675)
**EBERHARDT, P.**, Trapping of the solar wind in solids. I., 20: 44697
**ECCLES, S. F.**, Reaction $^{25}$Mg$(d,p)^{26}$Mg at 8.0 Mev, 20: 44725
**ECHIGOYA, Etsuro**, Catalytic hydrogen exchange of aniline on supported metal catalysts, 20: 43275
**ECKARDT, A.**, Dismountable pulse tube for nanosecond technique, 20: 43644
**ECKELMAN, William**, Reaction of recoiling silicon atoms with phosphine and silane, 20: 43315
**ECOCHARD, Rene**, Effects of x-irradiation on the meiosis of Vicia faba, 20: 42921
**EDELMAN, Ralph E.**, Heat treatment and mechanical properties of a U–2% Mo–2% Zr–2% Nb–0.5% Ti alloy, 20: 43883 (AD-637777)
**EDGECUMBE, J.**, Simple bakeable thin foil vacuum window, 20: 44066
**EDINGTON, J. W.**, Slip and fracture in single crystals of thoria, 20: 43943
**EDVARSON, K.**, Nuclear debris in upper atmosphere, 20: 43524
**EDWARDS, D. N.**, Interactions K$^0$-p and S-wave kaon-nucleon scattering lengths, 20: 44244
**EDWARDS, Howard D.**, Ionospheric winds measured by gun-launched projectiles, 20: 44447
**EDWARDS, Lois A.**, Electronic data processing method assessment of potential off-site radiological effects, 20: 43609
**EFIMOV, Z. F.**, Energy-momentum tensor of interacting fields, 20: 44389
**EGOROV, E. A.**, Using magnetic-field pulse modulation for recording original form of NMR and EPR spectra, 20: 43657
**EGOROV, E. V.**, Radiation-chemical synthesis of new mineral-organic ion-exchange materials, 20: 43311
**EHLERS, K.**, Fuel elements (AVR), 20: 45135
**EICHENAUER, B.**, New principles for quantization of relativistic field theories, 20: 44284
**EICK, Harry A.**, Preparation and some properties of $Nd_2O_2C_2$, 20: 43214
**EISENBERG, J. M.**, Core excitation of $^{20}$Ne, 20: 44792
**EISENBUD, Merril**, Natural radiation dose to indigenous rodents on the Morro do Ferro, Brazil, 20: 43606
**EISENSTAEDT, Jean**, Two-body problem in Einstein-Maxwell theory, 20: 44483
**EISLER, J. D.**, Near-surface spalling from a nuclear explosion in a salt dome, 20: 43462 (UCRL-13225)
**EISLER, P.**, Inefficient charge collection in silicon surface barrier detectors, 20: 43705
**EISLER, William J. Jr.**, Separation and performance capabilities of liquid scintillation counters used in dual isotope studies, 20: 43098
**ELDRIDGE, J. S.**, Secondary standardizations using computer techniques to normalize multiple $\gamma$-ray spectra for direct efficiency determinations, 20: 43380 (ORNL-P-2432)
**ELDRIDGE, J. S.**, Standardization of $^{197}$Hg, 20: 43381 (ORNL-P-2433)
**ELEKES, Istvan**, Preparation of $^{131}$I-labeled hippuran, 20: 43388
**ELENSKII, Ya. S.**, Remarks on investigation $\pi^-$-p interactions in heavy liquid bubble chambers, 20: 44177 (NP-16278)
**ELISEEVA, V. D.**, Influence of inert gases on tungsten recrystallization, 20: 43937
**ELLIOTT, R. O.**, Effects of 2 at.% rare-earth additions on $\gamma \rightleftarrows \alpha$ transforma- of Ce, 20: 45011
**ELLIS, D.**, Search for a baryon of positive strangeness, 20: 44195
**ELLIS, G. F. R.**, Theory of gravitation, 20: 44498
**ELLIS, M. M.**, Covalency in rare-earth trichlorides, 20: 43241
**EL SAIS, Khussein**, Magnetic hyperfine structure of $^{155}$Gd levels in Gd and $GdAl_2$, 20: 44832
**EMELEUS, K. G.**, Source of error in plasma electron oscillation measurements, 20: 44940
**EMPSON, F. M.**, Model and underground studies of the influence of stress, temperature, and radiation on flow and stability in rock salt mines, 20: 45217 (ORNL-P-2126)
**ENGELMANN, P.**, Development of fast breeder reactors in the Soviet Union, 20: 45159
**ENGELMANN, P.**, Experimental test of time-reversal invariance in $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$, 20: 44251
**ENGFER, R.**, Elastic electron scattering from lead and bismuth at 53 Mev, 20: 44771
**ENGFER, R.**, Nuclear charge radius difference for $^{46}$Ti–$^{50}$Ti, 20: 44789
**ENGLISH, J. L.**, Dynamic corrosion studies for HFIR, 20: 43833 (ORNL-TM-1030)
**ENGLMAN, Robert**, Operator for spin-forbidden transitions, 20: 44124
**ENZ, Charles P.**, Representation of group generators by boson or fermion operators application to spin perturbation theory, 20: 44304
**EPSTEIN, Samuel**, Oxygen isotope studies of Ivory Coast tektites and impactite glass from Bosumtwi Crater, Ghana, 20: 43511
**ERBER, Thomas**, High-energy electromagnetic conversion processes in intense magnetic fields, 20: 44061
**ERDAS, F.**, Reactions $d(p,\gamma)^3$He and $d(n,\gamma)^3$H, 20: 44748
**EREMEEV, V. F.**, Mitogenetic radiation of cardiac muscle of animals under normal physiologic conditions, 20: 42877
**ERGINSOY, Cavid**, Channeling and related effects in the passage of charged particles through crystal lattices, 20: 44991 (BNL-10544)
**ERICKSON, C. W.**, Determination of plasma potentials and ion energies by ion extraction and energy analysis, 20: 44956
**ERSHKOVICH, A. I.**, Motion of charged particles in the vicinity of the neutral point, 20: 44460
**ERSHOV, B. G.**, EPR spectra of irradiated frozen aqueous solutions. II., 20: 43309
**ERSHOV, B. G.**, EPR spectra of irradiated frozen aqueous solutions. III., 20: 43310
**ERSKINE, John R.**, Computer program for automatic decomposition of spectra from charged-particle reactions, 20: 44656 (TID-23315)
**ERWIN, Harold E.**, Prog. rpt. on purification and crystallization of amorphous B powder, annual, 7/65-6/66, 20: 43090 (TID-23342)
**ESCHBACH, E. A.**, Possible optimum use of thorium and uranium employing crossed-progeny fuel cycles, 20: 45096 (BNWL-289)
**ESCHKE, Wilhelm**, Ozone concentrations in uv irradiation rooms, 20: 43011
**ESCHRICH, H.**, Remotely operated pipetting device, 20: 43077 (NP-16214)
**ESKOLA, K.**, Dead time correction of pulse height spectra with computer, 20: 43715
**ETEMAD, Galen A.**, Oxidation and mechanical performance of tungsten at

high temperatures and high pressures, 20: 43925

**ETIEVANT, Claude,** Allowed bands for wave generation through nonlinear effects in a plasma, 20: 44893

**ETTLINGER, L.,** $\pi^+p$ Elastic differential cross sections from 2.3 to 4.0 Bev/c, 20: 44248

**EULER, Karl Joachim,** New methods of direct energy conversion, 20: 44169

**EVANS, D. E.,** Light scattering by plasmas, 20: 44938

**EWBANK, W. B.,** Revised A chains. $A = 187$, 20: 44714

**EWING, Alicia M.,** Particle-size distribution of low-density plasma lipoproteins, 20: 42717 (UCRL-16246, pp 176-85)

**EWING, C. T.,** High temperature PVT properties of Na, K, and CS, 20: 43944

**EWING, C. T.,** High temperature vapor pressures of Na, K, and Cs, 20: 43945

**EWING, C. T.,** High temperature specific volumes of liquid Na, K, and Cs, 20: 43946

**EYRING, Edward M.,** Equilibrium and kinetic $D_2O$ solvent isotope effects involving N...H–O and N–H...O intramolecular H bonds, 20: 43287

**EYRING, L.,** Praseodymium–oxygen system, 20: 43967

# F

**FABIANI,** Fluctuations in total neutron cross sections of Na, Al, Si, P, S in the energy interval from 5.0 to 8.5 Mev, 20: 44743

**FABRI, Jean,** Operation of plasma accelerators using progressive waves, 20: 44891

**FABRICANT, Stephen J.,** Ultracentrifuge rotor temperature and speed measurement by radio telemetry, 20: 43637 (UCRL-16246, pp 168-75)

**FACCHINI, Ugo,** Low-energy nuclear physics and development of nuclear applications, 20: 43764

**FADEEVA, V. I.,** Peculiarities of atomic structure of Ta–Nb solid solution, 20: 43975

**FAHR, Dieter,** Strengthening mechanisms of ultra-high-strength austenitic steel, 20: 43916 (UCRL-16922)

**FAILLA, Patricia,** Strontium retention in mice treated with thyroid hormone, 20: 42769

**FAINBERG, Ya. B.,** Spatial and temporal correlations of electric fields in a weakly turbulent plasma, 20: 44924

**FAIR, D. R. R.,** Magnox stations: a success story, 20: 45171

**FAITH, T. J. Jr.,** Discharge dynamics in the large diameter magnetically confined ion gas laser, 20: 44410

**FAIVRE, J. C.,** Quadrupole and octupole excitations of spherical even-even nuclei in the region of closed shells, 20: 44799

**FAIVRE, J. C.,** Second-order excitation in the inelastic scattering of $\alpha$ particles, 20: 44795

**FALCONER, David G.,** Optical processing of bubble chamber photographs, 20: 43676

**FAM, Wadie M.,** Effect of coronary vasodilatation on myocardial distribution of tritiated water, 20: 42763

**FANFANI, Gilberto,** Mucoprotein urine in radiation injuries. I., 20: 42960

**FANG, P. H.,** Kinetics of complex defect annealing in silicon, 20: 43968

**FARAGGI, H.,** Quadrupole and octupole excitations of spherical even-even nuclei in the region of closed shells, 20: 44799

**FARAGGI, H.,** Second-order excitation in the inelastic scattering of $\alpha$ particles, 20: 44795

**FARLEY, F. J. M.,** Anomalous magnetic moment of the negative muon, 20: 44207

**FASOLI, U.,** Fluctuations in total neutron cross sections of Na, Al, Si, P, S in the energy interval from 5.0 to 8.5 Mev, 20: 44743

**FAST, E.,** Interpretation and evaluation of integral cross sections by reactivity measurements, 20: 44621 (CONF-660303, pp 773-81)

**FAST, Edwin,** Techniques for determining ETA for the thermally fissionable isotopes, 20: 44626 (CONF-660303, pp 919-32)

**FAULKNER, John,** Expected number of blue-shifts and red-shifts of ejected sources, 20: 44085

**FAUSTOV, R.,** Current algebra and mass formula, 20: 44328

**FAW, R. E.,** Track effects in radiation-induced chemical reactions, 20: 43377

**FAY, Marie,** Conference on applications of x-ray analysis, Denver, 8/65, 20: 43267

**FEATHER, N.,** Objective criterion of the limit of useful sophistication of the semi-empirical mass equation, 20: 44814

**FEDER, J.,** Homogeneous nucleation and growth of droplets in vapors, 20: 43674

**FEDERMAN, P.,** Nuclear energy levels of calcium isotopes, 20: 44762

**FEDOROV, M. A.,** Boundary condition of the Josephson effect, 20: 44575

**FEDOTOV, V. P.,** Inactivation of 17-oxycorticosteroids in liver of dogs exposed to radiation, 20: 42808

**FELDMAN, Cyrus,** Survey of sensitivity limits for spectrographic determination of trace impurities in $U_3O_3$, 20: 43079 (ORNL-TM-1590)

**FELDMAN, Joseph L.,** Nuclear magnetic resonance local-magnetic-field shift in solid xenon, 20: 44143

**FELIX, M. C.,** Electrification of polyethylene and polystyrene after $\gamma$ irradiation, 20: 43337

**FELKER, J. K.,** Ionospheric rarefaction following rocket transit, 20: 44459

**FELTZ, E. T.,** Mitigation of secondary disease in mice receiving bone marrow, 20: 42995

**FENNER, N. C.,** Ion energies in the plasma produced by a high power laser, 20: 44932

**FERLENGHI, E.,** Transverse resistive-wall instability of extremely relativistic beams of electrons and positrons, 20: 44058

**FERMANIAN, J.,** Comparative evaluation of oophorectomy and radiation castration according to excretion of urinary gonadotropins, 20: 43044

**FERRIS, Leslie M.,** Solubility of niobic oxide and niobium dioxyfluoride in nitric acid–hydrofluoric acid solutions at 25°C, 20: 43226

**FERRONI, S.,** Photodisintegration of $^6$Li at high energy, 20: 44644 (LNF-66/32)

**FERTIK, S. M.,** Condenser batteries with 625-kJ stored energy for producing strong magnetic fields, 20: 43457

**FEUERHAKE, Inge,** Beta spectrometer with liquid scintillator for samples of dry powder with low specific activity, 20: 43682

**FEUVRAIS, L.,** Comparison of (d,t) and (d,$^3$He) cross sections, 20: 44794

**FIDONE, Ignazio,** Allowed bands for wave generation through nonlinear effects in a plasma, 20: 44893

**FIEBER, W.,** Variation (27-day) of the diurnal pattern of the intensity of cosmic radiation, 20: 44154

**FIELDHOUSE, P.,** Measurements and calculations of the Doppler effect on the reactions $^{238}$U(n,$\gamma$), $^{235}$U(n,f) and $^{239}$Pu(n,f) with neutrons in the energy range 0-25 kev, 20: 44627 (CONF-660303, pp 933-8)

**FIELDHOUSE, P.,** Revision of the Harwell $^{240}$Pu source strength and $\bar{\nu}$ for $^{235}$U and $^{252}$Cf, 20: 44594

**FILIP, Gh.,** Extraction of thorium by tributyl phosphate from nitric solutions, 20: 43450

**FILIPPOV, L. P.,** Thermal properties of molybdenum at elevated temperatures, 20: 43977

**FILIPPOV, N. V.,** Dynamics of a non-cylindrical Z-pinch plasma sheath at a stage prior to cumulation, 20: 44872 (LA-tr-66-58)

**FILIPPOVA, T. I.,** Dynamics of a non-cylindrical Z-pinch plasma sheath at a stage prior to cumulation, 20: 44872 (LA-tr-66-58)

**FILLMORE, F. L.,** Effective group absorption cross-sections and resonance overlap, 20: 44582 (NAA-SR-11963)

**FILLMORE, F. L.,** GRISM: code to generate multigroup constants from microscopic neutron cross section data, 20: 44584 (NAA-SR-11980 (Vol.3))

**FILOZOV, A. F.,** Ionization measurements in streamer chamber, 20: 43691

**FINCH, C. B.,** Single-crystal growth of cerium dioxide from lithium ditungstate solvent, 20: 43818

**FINK, H. J.,** Maximum lossless current in a superconducting foil with a surface sheath, 20: 44558

**FINKE, J.,** Power plant cycles for dual-purpose plant applications, 20: 45188

**FINKEL, V. A.,** Crystal structure of Tb at 120 to 300°K, 20: 45043

**FINKELSTEIN, R.,** Quantization in space with torsion, 20: 44308

**FINLAY, J. M.,** Human Ca metabolism using long-term whole body tracer measurements, 20: 42764

**FINOCCHIARO, G.,** Charge exchange $\bar{p}p \rightarrow \bar{n}n$ at 5, 6, 7, and 9 Bev/c, 20: 44227

**FINOCCHIARO, G.,** Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230

**FINZI, U.,** Physical mechanism of the radiofrequency plasma, 20: 44929

**FIRSTENBERG, A.,** Prog. rpt. on kinetic studies of heterogeneous water reactors, 1–3/66, 20: 43484 (STL-372-38)

**FISCHER, E. O.,** Tricyclopentadienylneptunium chloride, 20: 43230

**FISCHER, Fred W.,** Current density distribution in magnetohydrodynamic generator with segmented electrodes, 20: 44165 (IPP-3/41)

**FISCHER, Gaston,** Critical magnetic field of thin superposed films, 20: 44543

**FISCHER, W.,** $\rho'$ trajectory and its contribution to NN and $\pi$N charge exchange scattering, 20: 44222

**FISER, B.,** Measurement of airborne active deposit from $^{22}$Rn, 20: 43525

**FISH, Yu. L.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271

**FISHER, G. P.,** New $T \geq 1$ Di-pion at 965 Mev, 20: 44229

**FISHER, H. Leonard,** Estimation of dosage to thyroids of children in U. S. from nuclear tests in Nevada, 1952–55, 20: 43590 (UCRL-14707)

**FISHER, Philip C.,** Resolution of x-ray sources at low galactic longitude, 20: 44091

**FITCHEN, D. B.,** $F_2^+$ center in NaF, 20: 45029

**FITCHEN, D. B.,** Zero-phonon line luminescence at color centers in alkali halides, 20: 44994 (NYO-3464-2)

**FITI, Maria,** Radiolysis of acetylene in solution. IV., 20: 43341

**FITZ GIBBON, J. T.,** Anticontamination clothing: no buttons, zippers, or taping required, 20: 43575 (CONF-660621-1)

**FLAHERTY, B. J.,** Ionospheric electron content during declining phase of sunspot cycle, 20: 44449

**FLANARY, J. R.**, Sand filtration of foreign research reactor feed solutions, 20: 43426 (ORNL-TM-1650)
**FLEISCHMANN, EWALD**, Leukocyte count as criterium of toxicity from combined use of radiation and cytostatic substances, 20: 42965
**FLINT, H. T.**, Quantum equation and the theory of fields, 20: 44401
**FLINT, Richard Foster**, Radiocarbon. 8., 20: 43560
**FLOHR, B.**, Variation (27-day) of the diurnal pattern of the intensity of cosmic radiation, 20: 44154
**FLORES, J.**, Analysis of the BCS ground state for a charge-independent pairing interaction, 20: 44734
**FLUHARTY, R. G.**, Analytical descriptions of the sub-cadmium cross section of $^{233}$U, $^{235}$U, $^{239}$Pu, and $^{241}$Pu, 20: 44629 (CONF-660303, pp 985-96)
**FLUHARTY, R. G.**, Fission cross section of $^{241}$Pu from 20-200 ev as determined from a nuclear explosion, 20: 44625 (CONF-660303, pp 910-18)
**FOCACCI, M. N.**, Structure within the R(1675) boson and possible structure within the $A_2$(1290), 20: 44245
**FOCHEM, Kurt**, Question of daily rhythmic variations in radiation sensitivity in tumor-bearing mice and control animals, 20: 43048
**FONDA, L.**, Analytic properties of resolvents and completeness, 20: 44707
**FONDA, L.**, Bound states of a relativistic system, 20: 44335
**FONG, D.**, $\bar{p}p$ elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263
**FONTAN, Jacques**, Biological activity of natural ionizing radiations, 20: 42886
**FORD, G. P.**, Thermal neutron-induced fission cross section of $^{242m}$Am, 20: 44708
**FORD, John Brian Malpas**, Improvements in or relating to radioactive material containers, 20: 43475
**FOREST, Hugues**, High energy $\gamma$ radiation by means of high resolution pair spectrometer, 20: 43684
**FORRESTER, R. E.**, Irradiation behavior of unalloyed hypostoichiometric UC, 20: 45113 (NAA-SR-11440)
**FORTE, M.**, PNC effects in radiative capture of polarized neutrons: case of $^{2}$H(n,$\gamma$) and $^{113}$Cd(n,$\gamma$), 20: 44633 (EUR-3053.e)
**FORTUNE, M. B.**, Accountability of $UF_6$ supplied to Paducah Gaseous Diffusion Plant by private firm, 20: 43062 (CONF-661011-1)
**FOSCHI, G. C.**, Modification of duration of physiologic activity of insulin subjected to labeling with $^{131}$I, 20: 42760
**FOSCHI, G. C.**, Modification of biologic activity of labeled insulin, 20: 42761
**FOSSHEIM, K.**, Ultrasonic evidence for strong coupling of electrons to transverse phonons in single-crystal indium, 20: 44553
**FOSTER, C. C.**, Calcium-40(d,p)$^{41}$Ca proton polarization near the j-dependent cross-section minimum, 20: 44839
**FOSTER, H. J.**, Prog. rpt. on ceramic materials for reactor applications, 7/61–6/62, 20: 43900 (NBS-D-150)
**FOSTER, John E.**, Determination of Fe in Ta and Nb by atomic absorption spectrophotometry, 20: 43162
**FOURCY, Andre**, Applications of neutron activation analysis in plant biology and agronomy, 20: 43060 (CEA-R-2967)
**FOURNET, G.**, Pressure contacts between a superconductor and a normal metal, 20: 44526
**FOWKES, W. R.**, Refinements in precision kilovolt pulse measurements, 20: 43634 (SLAC-PUB-199)
**FOWLER, J. L.**, Differential scattering of neutrons from oxygen and intermediate states, 20: 44651 (ORNL-P-2434)
**FOWLER, R. D.**, Sensitive detection of superconductivity by changes in inductance and losses of a resonant bridge, 20: 44508
**FOWLER, Scott W.**, Prog. rpt. on element and energy transfer in lower trophic levels in marine environment, 4/63–3/66, 20: 42731 (RLO-1751-2)
**FRAME, A. G.**, Fast reactors: on the line by '71, 20: 45172
**FRANA, J.**, Energy levels and rotation-particle coupling in $^{155}$Eu, 20: 44736
**FRANCK, G.**, Analysis of the reactions $^{25}$Mg(p,p)$^{25}$Mg and $^{24}$Mg(d,p)$^{25}$Mg at 5 and 6 Mev, 20: 44737
**FRANK, J. E.**, Irradiation behavior of unalloyed hypostoichiometric UC, 20: 45113 (NAA-SR-11440)
**FRANK, L. A.**, Low-energy electron intensities in outer radiation zone during geomagnetic storms, 20: 44454
**FRANK, Willy H.**, Decontamination efficiency of slow sand filter action in ground water recharge, 20: 43522
**FRANKEL, S.**, Observation of x-rays from spark discharges in a spark chamber, 20: 43714
**FRANKEVICH, E. L.**, Chemical effect of ions and electrons recombination in irradiated n heptane at 77°K, 20: 43312
**FRANKLIN, N. L.**, Oxide fuels: how U. K. will fill the need, 20: 43874
**FRANKLIN, N. L.**, Plutonium: reserved for fast reactors, 20: 43875
**FRANKLIN, R. N.**, Damping of electrostatic waves in a spatially nonuniform plasma, 20: 44935
**FRANTZ, Leo M.**, Wave-packet derivation of field-theoretic scattering amplitude, 20: 44318
**FRANZEN, L. F.**, Selection and safety evaluation of reactor sites, 20: 45054
**FRASER, A. S.**, High-temperature embrittlement of stainless steel irradiated in fast fluxes, 20: 44015
**FRASER, D. I.**, Gamma irradiation as means of extending storage life of haddock fillets, 20: 43770
**FRATINO, P.**, Modification of duration of physiologic activity of insulin subjected to labeling with $^{131}$I, 20: 42760
**FRATINO, P.**, Modification of biologic activity of labeled insulin, 20: 42761
**FRAUTSCHI, Steven**, Regge trajectories and minima in differential cross sections, 20: 44264
**FREESTONE, R. M.**, Proton-recoil neutron spectrometry with organic scintillators, 20: 43672 (ORNL-P-2471)
**FREIFELDER, David**, A technique for starvation of E. coli of thymine, 20: 42716 (UCRL-16246, pp 164-7)
**FREIFELDER, David**, Single-strand breaks in duplex DNA of coliphage T7, 20: 42715 (UCRL-16246, pp 145-55)
**FREINDL, Ludwik**, Semiconductor system for charged particles identification, 20: 43717
**FRENCH, R. A.**, Ginzburg-Landau parameter ($\kappa_0$) for V, 20: 44537
**FREUND, Harold G.**, Transfer processes in irradiated crystalline solid solutions, 20: 43317
**FRICK, G.**, Beta$^{+}$ radioactivity of $^{30}$S, 20: 44733
**FRICKE, W.**, Loading device (AVR), 20: 45139
**FRICKE, W.**, Shutdown equipment (AVR), 20: 45138
**FRIDDLE, R. J.**, Effects of high pressure on the alpha $\rightleftarrows$ beta transformation in Pu, 20: 43953
**FRIDENSHTEIN, A. Ya.**, Morphologic changes in thymus and spleen of newborn mice exposed with x rays, 20: 42880
**FRIEDMAN, H. George Jr.**, Complexes of trivalent lanthanide ions. III., 20: 43215
**FRIES, D. E.**, Geometrical reconstruction of high energy interactions in spark chamber magnet arrangements, 20: 43711
**FRIESENHAHN, S. J.**, Neutron capture cross section of the W isotopes from 0.01 to 10 ev, 20: 44605 (CONF-660303, pp 182-203)
**FRIESS, Richard**, Radioprotective action of iproniazid, 20: 42991
**FROEHLICH, F.**, Discoloration of KCl and NaCl crystals under action of gamma radiation, 20: 44996
**FROHNER, F. H.**, Neutron capture cross section of the W isotopes from 0.01 to 10 ev, 20: 44605 (CONF-660303, pp 182-203)
**FROLOV, G. V.**, Backward Compton scattering at high energies, 20: 44234
**FROLOV, G. V.**, Double logarithmic asymptotics of quantum electrodynamics, 20: 44361
**FROLOV, S. F.**, Radiation protection effect of apilac in animals, 20: 43009
**FROLOVA, U. K.**, Ion hydrolysis of rare earths and Y in aqueous solutions, 20: 43221
**FRYE, G. M. Jr.**, Spark chamber for gamma-ray astronomy, 20: 43734
**FRYE, Glenn M. Jr.**, Upper limits to cosmic $\gamma$ rays in the range 30 to 500 Mev, 20: 44947
**FU, Chumin**, Evidence for a K*(1320) resonance, 20: 44265
**FUCCILLO, D. A.**, Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758
**FUJII, Isao**, Determination of O in Ti metal by fast neutron activation method, 20: 43111
**FUJII, Shunichi**, Zinc-65 uptake by Ehrlich ascites cancer cells, 20: 42775
**FUJII, Yasunori**, Amplitudes of nonleptonic decays of K mesons, 20: 44255
**FUJIMOTO, Tatsuro**, Radiation protective effects of local administered cysteamine, 20: 42983
**FUJISHIRO, Masatosi**, Non-pulsed time-of-flight neutron spectrometer, 20: 44592
**FUJITA, Hitoshi**, Interaction of Ca, Ba, and La ions with built-up films of stearic acid and stearates, 20: 43238
**FUJITA, Junji**, Echelle monochromator and application to ion temperature measurement, 20: 44920
**FUJITA, M.**, Comparative metabolism of Cs and K in mammals, 20: 42768
**FUJITA, M.**, Ingestion, excretion, and accumulation of fallout $^{137}$Cs in man, 20: 42794
**FUKUDA, Kyue**, Effect of pulsed x rays on a $BF_3$ counter, 20: 43756
**FUKUDA, Kyue**, Fluorine-19 ($\gamma$,n) cross section from threshold to 14 Mev, 20: 44683
**FUKUDA, Takao**, Leukemic reticulosis and allied disorders, 20: 42729
**FUKUI, K.**, Charge determination by thin-down track width measurements, 20: 43706
**FULDE, Peter**, Numerical calculations on high-field superconductivity, 20: 44520
**FULINSKI, Andrzej**, Pauli master equations and one-particle distributions, 20: 44181
**FULLAM, H. T.**, Summary of $^{233}$U studies in Pu chemistry laboratory,

20: 43427 (RL-SEP-712)
**FULLER, F. L.,** Use of conformal mapping to improve field uniformity of electromagnet, 20: 44064
**FULTZ, S. C.,** Photoneutron measurements obtained with monochromatic photons, 20: 44660 (UCRL-70002)
**FUNKE, L.,** Energy levels and rotation-particle coupling in $^{155}$Eu, 20: 44736
**FUNSTEN, H. O.,** Properties of an infinite focusing channel with successive quadrupole rotations not equal to 90 deg, 20: 44055
**FURCHNER, J. E.,** Movement of discrete particles through gastrointestinal tract, 20: 42740 (LA-DC-7764)
**FURLAN, M.,** Nitrogen metabolism in frog liver after whole-body irradiation. V., 20: 42787
**FURUHASHI, Akira,** Proof of the formula for the Rossi-$\alpha$ method, 20: 45083
**FURUTA, Junichiro,** Gamma-induced conductivity in insulating polymers. II., 20: 44997
**FURUTA, Junichiro,** Non-pulsed time-of-flight neutron spectrometer, 20: 44592

## G

**GAARDE, C.,** Isobaric analogue states from proton excitation of medium-weight even nuclei, 20: 44761
**GABET, A.,** Control of beamed particles from the accelerator system of the Saturn synchrotron, 20: 44048
**GABOS, Zoltan,** Polarization effects in the disintegration of $\mu^-$ mesons, 20: 44272
**GABOS, Zoltan,** Symmetry transformation of the Dirac field, 20: 44385
**GABROVSEK, Zdravko,** Building of the TRIGA reactor at Ljubljana, 20: 45212
**GACHOK, V. P.,** Quasi-analytic functionals and self-adjointness of field operators, 20: 44329
**GADALLA, A. M. M.,** Equilibrium relationships in the system $CuO–Cu_2O–ZrO_2$, 20: 43978
**GADALOV, A. N.,** Telemetering of pulses from scintillating cosmic ray detector over wide dynamic range, 20: 43687
**GADIOLI, E.,** Finite range of data errors affecting the analysis of a fluctuating excitation function, 20: 44745
**GAERTTNER, E. R.,** Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)
**GAETA, Neil A.,** Public health evaluation of nuclear power plants, 20: 43632
**GAILLARD, M.,** Comparison of (d,t) and (d,$^3$He) cross sections, 20: 44794
**GAILLARD, P.,** Comparison of (d,t) and (d,$^3$He) cross sections, 20: 44794
**GAISCH, H.,** Pasteurization of fruit juices by irradiation, 20: 43787
**GAL, I. J.,** Solvent extraction of Fe(III) and U(VI) with mixtures of tri-n-octylamine and thenoyltrifluoroacetone in benzene and nitrobenzene, 20: 43434
**GALLINA, F.,** Malignant tumors of testicles, 20: 43038
**GALLMANN, A.,** Analysis of the reactions $^{25}$Mg(p,p)$^{25}$Mg and $^{24}$Mg(d,p)$^{25}$Mg at 5 and 6 Mev, 20: 44737
**GALLMANN, A.,** Beta$^+$ radioactivity of $^{30}$S, 20: 44733
**GALLMANN, A.,** Fluctuations of the cross sections of the reactions $^{25}$Mg(p,p)$^{25}$Mg and $^{24}$Mg(d,p)$^{25}$Mg, 20: 44738
**GALSTYAN, D. A.,** Quasi-nucleon interactions between 24 Bev/c protons and nuclei of a photographic emulsion in a strong magnetic field, 20: 44280
**GANDOLFO, E.,** Further observations on treatment of malignant tumors of tests, dysembryoma, 20: 43034
**GANGULY, P.,** Lambda-binding energies of hypernuclei. I., 20: 44702
**GANNON, William C.,** Determination of Fe in Ta and Nb by atomic absorption spectrophotometry, 20: 43162
**GARBAR, N. P.,** Device for spectral measurements of 1-f photocurrent noises in semiconductors, 20: 43653
**GARDNER, D. S.,** Effect of $\gamma$ rays on storage life and chipping qualities of Ontario grown Kennebec potatoes, 20: 43773
**GAREEV, F. A.,** Closed shells for $Z > 82$ and $N > 126$ in a diffuse potential well, 20: 44640 (JINR-P-2793)
**GAREEV, F. A.,** Closed shells for $Z > 82$ and $N > 126$ in a diffuse potential well, 20: 44774
**GARFINKEL, A. F.,** Stopping power of Al for 5- to 12-Mev protons and deuterons, 20: 44034
**GARLICK, Ralph G.,** Compatibility of Ta, Nb, and their alloys with H, 20: 43832 (NASA-TN-D-3546)
**GARNIER, Michel,** Optical path variation of signals generated by a long-wave emitter and propagated in the whistling mode, 20: 44429
**GARRETA, D.,** Elastic scattering of polarized deuterons from $^4$He between 18 and 22 Mev, 20: 44750
**GASPAR, Peter P.,** Reaction of recoiling silicon atoms with phosphine and silane, 20: 43315
**GAST, R. C.,** Seven-point difference equations with arbitrary mesh spacing for neutron diffusion in 60° geometry by the integration technique, 20: 44590 (WAPD-T-1802)
**GATTO, R.,** $SU(6)_W$ algebra at infinite momentum, its tensor charges, and electric dipoles, 20: 44358
**GAUDREAU, Bernard,** Comparison of fluorine compounds of Hf and Zr, 20: 43206
**GAUR, P. K.,** Solvent extraction of Th from hydrochloric acid solutions, 20: 43444
**GAUSTER, W. F.,** Large-volume, highly uniform magnets, 20: 44030 (ORNL-P-2492)
**GAUTHIER, P.,** Purification and separation of $^{95}$Zr and $^{95}$Nb, 20: 43433
**GAUZIT, M.,** Disinsectization of African dried and smoked fish by means of irradiation, 20: 43778
**GAVRILINA, L. I.,** Effect of space-flight factors on hereditary structures of mammals, 20: 42986
**GAYLEY, R. I.,** Differential paramagnetic effect and harmonic generation in an enclosed superconductor, 20: 44544
**GAYLEY, R. I.,** New mode of field enhancement in superconducting tubes, 20: 44532
**GAZARYAN, K. A.,** Ionization measurements in streamer chamber, 20: 43691
**GEBALLE, T. H.,** Many more superconducting bismuth phases, 20: 44554
**GEDEONOV, L. I.,** Contamination of Atlantic Ocean by long-lived radionuclides 1963–1964, 20: 43540
**GEDEONOV, L. I.,** Study of the content of long-lived fission-fragment radionuclides in the Black Sea, 20: 45227
**GEHEM, L.,** Requirements and problems of high activity waste management at the Eurochemic reprocessing plant, 20: 45232
**GEISS, J.,** Trapping of the solar wind in solids. I., 20: 44697
**GELBARD, E. M.,** SCAT-1 program to compute $T_{ll}^{n}$ matrices on the Philco-2000, 20: 44663 (WAPD-TM-571)
**GELFMAN, A. Yu.** Finding optimum conditions in radioactivation analysis of binary systems, 20: 43149
**GELFORT, E.,** Production of stationary plasma beams by means of a glow discharge at normal pressures, 20: 44900
**GELTSEL, M. Yu.,** High-voltage nanosecond pulse generator, 20: 43655
**GEMMEL, W.,** Approach to the physics of thorium loaded beryllia moderated reactors, 20: 45176
**GEN, M. Ya.,** Nuclear $\gamma$ resonance at highly dispersive Sn, 20: 44149
**GENCO, Joseph M.,** Prog. rpt. on fission-product deposition and its enhancement under reactor accident conditions, 4–6/66, 20: 45045 (BMI-X-10173)
**GENDROT, M.,** Spectroscopy of $^{208}$Pb by inelastic scattering of protons at 24.55 Mev, 20: 44772
**GENDROT, M.,** Spectroscopy of $^{207}$Pb by inelastic scattering of 24.5-Mev protons, 20: 44801
**GENS, T. A.,** Formation of U, Zr, and Th oxide microspheres by hydrolysis of droplets, 20: 43182 (ORNL-TM-1508)
**GENTER, E. I.,** Radioprotective actinn of inert gases and low molecular natcotics. V., 20: 43007
**GENZ, H.,** New principles for quantization of relativistic field theories, 20: 44284
**GEORGE, D. J.,** Baryon resonances as meson-baryon bound states with empirical selection rules, 20: 44249
**GEORGIADOU, E.,** Data on radiosensitization of fruit-spoilage fungi by chemical sensitizers, 20: 43784
**GEORGOPOULOS, S. G.,** Data on radiosensitization of fruit-spoilage fungi by chemical sensitizers, 20: 43784
**GERARDO, J. B.,** Electronic recombination in He and Ar afterglow plasmas, 20: 44854 (AD-630074)
**GERARDO, J. B.,** Test of the theory of Stark broadening of $H_\beta$, 20: 44943
**GEREVINI, T.,** Prog. rpt. on release of fission gases from irradiated $UO_2$, 1–3/66, 20: 43992 (EURAEC-1667)
**GERMAN, G. E.,** Weight scaling factors for SNAP reactor shields, 20: 45197 (NAA-SR-Memo-11971)
**GEROCH, R. P.,** Singularities in closed universes, 20: 44493
**GERRARD, Martha,** Gamma activation analysis of rocks and ores, 20: 43119
**GERRARD, Martha,** Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758
**GERRARD, Martha,** Radioisotopes in Romania, 20: 43769
**GERRARD, Martha,** Radioisotope production by nuclear explosion, 20: 43802
**GERRARD, Martha,** Selected abstracts of non-U. S. literature on production and industrial uses of radioisotopes, 20: 43757 (ORNL-TM-1505(Pt.2))
**GERTSENSHTEIN, M. E.,** Possibility of an oscillatory nature of gravitational collapse, 20: 44106
**GERWIN, R.,** Theory of collisional heating of plasma by magnetic pumping, 20: 44949
**GESKE, David H.,** Electron spin resonance study of $^{17}$O enriched p-benzosemiquinone anion radical, 20: 43224
**GETIYA, M. Sh.,** Radiation effects on dislocation densities in ionic crystals, 20: 43305
**GEY, Wolfgang,** Influence of lattice structure on superconductivity in

thallium, 20: 44566

**GHIRARDELLI, E.,** Effects of x radiation on RNA of neoblasts of Polycelis nigra during regeneration, 20: 42933

**GHIRARDI, G. C.,** Analytic properties of resolvents and completeness, 20: 44707

**GHIRARDI, G. C.,** Bound states of a relativistic system, 20: 44335

**GHOSH, Ajit Kumar,** Carcinogenesis in naturally tumour-resistant mice, 20: 42873

**GIANNONE, P.,** Advanced evolution of a helium star of intermediate mass, 20: 44105

**GIBB, F. R.,** Clearance of uranium dioxide dust from lungs following inhalation exposures, 20: 42767

**GIBBS, Hyatt M.,** Large aperture, high efficiency ion detector, 20: 43735

**GIBBS, K. P.,** Magnox stations: a success story, 20: 45171

**GIBSON, Gordon,** GAM-TNS cross section library for the n+W reactions, 20: 44589 (WANL-TME-1472)

**GIBSON, W. R.,** $T = 2$ isobaric multiplet at mass 24, 20: 44758

**GIELOW, F.,** Strontium-90 in beagle hair, 20: 42780

**GIERE, Albert C.,** Relativistic hydromagnetic waves and group velocity, 20: 44409

**GIESCH, M.,** Anomalous magnetic moment of the negative muon, 20: 44207

**GIFFON, M.,** Remark about the regularization method, 20: 44330

**GIGAS, G.,** Neutron flux spectral determination by foil activation, 20: 44579 (CONF-660303, pp 532-53)

**GIGLI, A.,** Interference effects in Coulomb and nuclear scattering of polarized protons, 20: 44741

**GILAT, Eliezer,** Ecosystem in the coastal waters of the Ligurian Sea. II., 20: 42734

**GILFRICH, John V.,** Crystal structures of $LuMn_5$ and the $RMn_{12}$ compounds (where R = Gd, Tb, Dy, Ho, Er, and Tm), 20: 43918

**GILGUY, Roger,** Cryogenic equipment, 20: 44501 (CEA-R-3008)

**GILL, R. D.,** Comparison of signs of mixing ratios to model predictions, 20: 44784

**GILLESPIE, E.,** Search for a baryon of positive strangeness, 20: 44195

**GILLET, V.,** Stretch scheme, a microscopic description of rotations in nuclei, 20: 44810

**GILLI, R.,** Helium purification installation (AVR), 20: 45142

**GILLIS, J.,** Prog. rpt. on equations of motion of viscous fluid, final, 8/25/65. I., 20: 44404 (AD-628179)

**GILLSON, J. L.,** Synthesis of Mo and W bronzes at high pressure, 20: 43213

**GILLY, L.,** Silicon diodes used in neutron diffraction, 20: 43730

**GILMORE, Charles M.,** Oxidation resistant structural metals for high temperture applications, 20: 43842

**GILSON, Albert J.,** Bone density measurement by means of radioisotopic source photon attenuation, 20: 43049

**GINZBURG, M. B.,** Effects of radiation on Zn content of pancreas, 20: 42917

**GINZBURG, N. I.,** Effect of high pressure on superconducting transition temperature of 90Mo–10Re and 75Nb–25Mo, 20: 44568

**GIORGI, M.,** A measurement of the branching ratio $\omega \rightarrow$ neutrals/$\omega \rightarrow \pi^+ + \pi^- + \pi^0$, 20: 44176 (LNF-66/31)

**GIRARD, Bernard,** High-resolution NMR spectrograph, 20: 43685

**GIRARD, Olivier,** Hyperproduction of diphtheria and tetanus antibodies following irradiation, 20: 42887

**GIST, Clayton S.,** Influences of thermonuclear cratering test on populations of lizards, 20: 42732

**GLADKOV, V. S.,** Condenser batteries with 625-kJ stored energy for producing strong magnetic fields, 20: 43457

**GLADKOV, V. S.,** Performance of 625-kJ battery using physical model, 20: 43458

**GLAESER, Robert M.,** Microelectrophoretic and enzymatic studies concerning carbohydrate at surface of rat erythrocytes, 20: 42714 (UCRL-16246, pp 119-25)

**GLASSER, R. G.,** Experimental test of time-reversal invariance in $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$, 20: 44251

**GLASSFORD, P. M.,** P-V-T and internal energy data for He between 4.2 and 20°K at pressures of 100-1,300 atm, 20: 44507

**GLAZUNOV, P. Ya.,** EPR spectra of irradiated frozen aqueous solutions. II., 20: 43309

**GLAZUNOV, P. Ya.,** EPR spectra of irradiated frozen aqueous solutions. III., 20: 43310

**GLAZUNOV, P. Ya.,** Radiation-thermal cracking of low octante number straight-run gasoline in uniform temperature field, 20: 43336

**GLAZUNOV, S. G.,** Thermomechanical treatment of the $\beta$ alloy of the Ti–Mo–Cr–Fe–Al system, 20: 43961

**GLEESON, L. J.,** Magnetic field variations in temperate zone sporadic-E layers, 20: 44468

**GLENDENNING, Norman K.,** Test of a microscopic description of nickel isotopes by inelastic proton scattering, 20: 44658 (UCRL-16984)

**GLIGORIJEVIC, J.,** Radiodecontamination of skin by ultrasonics, 20: 42811

**GLOBERSON, Amiela,** In vitro studies on radiation lymphoid recovery of mouse spleen, 20: 42984

**GLUSHKOV, E. S.,** Experimental studies of the influence of nonuniform fuel distribution on the heat rate in reactors, 20: 45208

**GLUSHNEV, V. E.,** Radiation-thermal cracking of low-octane number straight-run gasoline in uniform temperature field, 20: 43336

**GNATOVICH, V.,** New data on the conversion electron spectra of $^{153}Dy$, $^{155}Dy$, and $^{157}Dy$, 20: 44639 (JINR-P-2729)

**GNUTZMANN, H.,** Shutdown equipment (AVR), 20: 45138

**GOBBI, B.,** Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230

**GODDEN, G.,** New $T \geq 1$ Di-pion at 965 Mev, 20: 44229

**GODFREY, T. G.,** Thermodynamic functions of nuclear materials: UC, $UC_2$, $UO_2$, $ThO_2$, and UN, 20: 43907 (ORNL-TM-1596)

**GODFREY, T. Gordon,** Thermodynamic properties of UC via the U–C–O system, 20: 43947

**GODOLI, G.,** Variations in relations of solar indices to E- and F-region character figures, 20: 44435

**GOEL, V.,** Dynamic strain aging of a high-strength steel, 20: 43915 (UCRL-16761)

**GOFF, J. R.,** Spark chamber for gamma-ray astronomy, 20: 43734

**GOI, Anna,** Serum lysozyme in animals subjected to whole-body x irradiation, 20: 42944

**GOIN, R. W.,** BORAX-V neutronics, 20: 45202 (ANL-6964)

**GOLAB, Zofia,** Reaction $\pi^+p \rightarrow \omega N^{*++}$ at high energies and the Regge-pole exchange model, 20: 44184

**GOL'DANSKII, V. I.,** Nuclear chemistry, 20: 43056 (JPRS-36943)

**GOLDANSKII, V. I.,** Nuclear $\gamma$ resonance on highly dispersive Sn, 20: 44149

**GOLDBERG, D. M.,** Effect of therapeutic radiation on serum and urine $\beta$-glucuronidase, 20: 43025

**GOLDBERG, M.,** Strong decay rates and $SU_3$, 20: 44331

**GOLDBERG, Murrey D.,** Cross section data compiling: present and future, 20: 44606 (CONF-660303, pp 226-34)

**GOLDBLITH, S. A.,** Food preservation problems in developing countries, 20: 42727

**GOLDBLITH, S. A.,** Quality and wholesomeness of radiation-pasteurized marine products, 20: 43768

**GOLDBLITH, Samuel A.,** Radiation sterilization of food, 20: 43772

**GOLDFEDER, Anna,** Carcinogenesis in naturally tumour-resistant mice, 20: 42873

**GOLDHABER, Gerson,** Evidence for a $K^*(1320)$ resonance, 20: 44265

**GOLDHABER, Gerson,** $K_2{}^0p$ interactions at low momentum, 20: 44250

**GOLDHABER, Sulamith,** Evidence for a $K^*(1320)$ resonance, 20: 44265

**GOLDHABER, Sulamith,** $K_2{}^0p$ interactions at low momentum, 20: 44250

**GOLDMAN, Robert D.,** Prog. rpt. on genetic alterations in human cells, 8/65–7/66, 20: 42707 (RLO-581-10)

**GOLDRING, G.,** Determination of the gyromagnetic ratios of some odd-A deformed nuclei from branching ratio measurements, 20: 44791

**GOLDSMITH, William A.,** Radioactive decontamination by slurrying with Yazoo and Zilpha clays, 20: 45221

**GOLIUSHKO, G. M.,** Condenser batteries with 625-kJ stored energy for producing strong magnetic fields, 20: 43457

**GOLOVANOV, Yu. N.,** Stress relaxation in uranium, 20: 43936

**GOLOVINA, N. V.,** Use of semiconductor counters of type p-l-n for study of nuclear reactions, 20: 43741

**GOLOVKINA, A. V.,** Effect of space-flight factors on hereditary structures of mammals, 20: 42986

**GOLUBEV, Yu. M.,** Measurement of activity of radioactive gases by spherical ionization chamber, 20: 43106

**GOLUBEVA, L. A.,** Influence of irradiation on properties of monocrystals of lithium fluoride, 20: 43307

**GOLUTVINA, M. M.,** Cesium-137 content in human bone, 20: 42741 (NP-16265)

**GOMEZ, R.,** $\bar{p}p$ elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263

**GOMEZ CRESPO, G.,** Calibration and standardization of thyroid radioiodine uptake measurements, 20: 43031

**GONCHARENKO, D. K.,** Motion of a plasma jet across a nonuniform magnetic field, 20: 44963

**GONCHARENKO, I. M.,** Morphologic changes in thymus and spleen of newborn mice exposed with x rays, 20: 42880

**GONCHARENKO, V. P.,** Motion of a plasma jet across a nonuniform magnetic field, 20: 44963

**GOODE, J. H.,** Sand filtration of foreign research reactor feed solutions, 20: 43426 (ORNL-TM-1650)

**GOODMAN, B.,** Derivation of van Hove-Glauber formula, 20: 44593

**GOODWIN, Leslie E.,** Compact actuator system for reactor control, 20: 45190 (DP-670)

**GOOSMAN, D. R.,** Energy levels of $^{37}K$, 20: 44838

**GOOSSENS, W.,** Reprocessing of irradiated fuel, 20: 43413 (EURAEC-1659)

**GOPAL, Kum. Sheila,** Isotope shifts ($C^{32}S$–$C^{34}S$) in the bands of the A $^1\Pi$–X $^1\Sigma^+$ system of CS, 20: 43209

**GORBACHEVA, N. A.,** Determination of U by measuring width of the

luminescence zone on chromatogram, 20: 43151
**GORBENKO-GERMANOV, D. S.,** Vibrational structure of the ground and excited levels of $UO_2^{2+}$ in $K_4[UO_2(CO_3)_3]$, 20: 43240
**GORBUNOV, E. P.,** Plasma density spatial distribution measurements by means of multi-beam microwave probing, 20: 44857 (IAE-1153)
**GORDEEV, V. V.,** Diffusion of nuclear reaction recoil products in different materials, 20: 43073 (JINR-P-2804)
**GORDON, C. M.,** Decay of $^{95}$Y, 20: 44722
**GORESLINE, H. E.,** Report of meeting of FAO/WHO/IAEA expert committee on technical basis for legislation on wholesomeness and microbiological safety of irradiated food, 20: 43786
**GORINGE, M. J.,** Measurements of extinction distance and absorption of high-energy electrons in crystals, 20: 45014
**GORIZONTOV, P. D.,** General radiation sensitivity of organisms, 20: 42849 (NP-16258)
**GOROBCHENKO, V. D.,** Polarization of antimony, yttrium, and copper nuclei in iron, 20: 44824
**GORODETZKY, Ph.,** Transition between rotational bands in $^{16}$O, 20: 44776
**GORODETZKY, S.,** Transition between rotational bands in $^{16}$O, 20: 44776
**GORRELL, Thomas C.,** Determination of axial flux and axial exposure distributions in HWCTR, 20: 45203 (DP-1045)
**GORSHKOV, G. V.,** Natural neutron background of the atmosphere and earth crust, 20: 43547
**GORSHKOV, V. G.,** Backward Compton scattering at high energies, 20: 44234
**GORSHKOV, V. G.,** Double logarithmic asymptotics of quantum electrodynamics, 20: 44361
**GORSKA-BULHAK, Z.,** Influence of $\gamma$-radiation on physico-chemical properties of linear saturated aliphatic polyesters. I., 20: 43342
**GORSKA-BULHAK, Z.,** Influence of $\gamma$-radiation on physico-chemical properties of linear saturated aliphatic polyesters. II., 20: 43343
**GOTTSCHALK, ALEXANDER,** Curve relating dose in time to pituitary histologic change following $\alpha$ irradiation, 20: 43016 (UCRL-16246, pp 58-65)
**GOTTSCHALK, Alexander,** Technique of patient alignment for pituitary irradiation, 20: 43017 (UCRL-16246, pp 66-73)
**GOUANERE, M.,** Comparison of (d,t) and (d,$^{3}$He) cross sections, 20: 44794
**GOUDERGUES, J.,** Elastic scattering of polarized deuterons by deuterium at 21.4 Mev, 20: 44231
**GOULDEN, Robert J.,** Determination of Fe in Ta and Nb by atomic absorption spectrophotometry, 20: 43162
**GOUTELARD, Claude,** Use of transmission curves to interpret back-scattering echos, 20: 44428
**GOVE, N. B.,** Revised A chains. A = 186, 20: 44713
**GOYA, H. A.,** Radioactivity release from radionuclide power sources. II., 20: 43592 (USNRDL-TR-1042)
**GOZANI, T.,** Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)
**GRABER, H.,** Energy levels and rotation-particle coupling in $^{155}$Eu, 20: 44736
**GRACHEV, B. N.,** Detection of C- and $C_x$-reactive protein in irradiated blood serum, 20: 42876
**GRACHYOV, B. D.,** Coherent bremsstrahlung radiation of 15-Mev electrons in a silicon monocrystal, 20: 45020
**GRACO, V. G.,** Photodisintegration of $^{6}$Li at high energy, 20: 44644 (LNF-66/32)
**GRACZYK,** Isotopic composition of water from Tarnobrzeg basin, 20: 43531
**GRAF, Regine,** Dose distribution by use of different filter elements in cones, 20: 43047
**GRAHAM, L. J.,** Low-temperature elastic properties of ZrC and TiC, 20: 43942
**GRANKOVA, L. P.,** Thermomechanical treatment of the $\beta$ alloy of the Ti–Mo–Cr–Fe–Al system, 20: 43961
**GRANQUIST, D. P.,** Inspection procedures for the application of safeguards to Yankee Nuclear Power Station, 20: 45108 (BNWL-119)
**GRANT, R. M. Jr.,** Effects of pre-irradiation annealing on the thermoluminescence and dielectric loss of LiF:Mg, 20: 45008
**GRANT, W. A.,** Ion bombardment of glass, 20: 45017
**GRASTY, William P.,** Container system for radioactive material, 20: 43476
**GRAUT, Jean,** Curvature of the shock wave in a shock tube, 20: 44890
**GRAY, A. L.,** Industrial applications of neutron activation, 20: 43160
**GRAY, R. J.,** Effect of curing stresses in epoxy resins, 20: 43906 (ORNL-P-2361)
**GREEBLER, P.,** User requirements for cross sections in the energy range from 100 ev to 100 kev, 20: 45092
**GREEN, Leonard Andrew,** Improvements in or relating to magnetohydrodynamic apparatus, 20: 44172
**GREENE, R. E.,** Chemistry of electromagnetically separated isotopes, 20: 43801
**GREENE, R. E.,** Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758
**GREENSLADE, D. J.,** General correlation of E.S.R. data for F-centers, 20: 43350
**GREENSTREET, B. L.,** ADDENDUM: influence of cross-sectional shape on irradiation-induced stresses in graphite columns, 20: 44000 (ORNL-TM-1574)
**GREENWOOD, J. A.,** Estimating fractional dose recovery effects, 20: 42829 (AD-635167)
**GREGORA, V.,** Preparation of rose bengal–$^{131}$I and the testing of its purity, 20: 43386
**GREGORY, William D.,** Superconducting transition and critical field of pure gallium single crystals, 20: 44545
**GRIBOV, V. N.,** Backward Compton scattering at high energies, 20: 44234
**GRIBOV, V. N.,** Double logarithmic asymptotics of quantum electrodynamics, 20: 44361
**GRIESS, J. C.,** Dynamic corrosion studies for HFIR, 20: 43833 (ORNL-TM-1030)
**GRIFFIN, A.,** Tomasch effect as a probe of the dispersion relation of electrons in "gapless" superconductors, 20: 44547
**GRIFFITHS, J. A.,** METHUSELAH II FORTRAN program and nuclear data library for physics assessment of liquid-moderated reactors, 20: 45063 (AEEW-R-480)
**GRIFFITHS, R. J.,** T = 2 isobaric multiplet at mass 24, 20: 44758
**GRIGORYAN, S. V.,** Problem of moving of hydrothermal solutions, 20: 43562
**GRIM, Eugene,** Kinetics of distribution of $D_2O$ in canine intestinal tissues, 20: 42748
**GRIMES, C. C.,** Far-infrared response of point-contact Josephson junctions, 20: 44548
**GRIMES, John Herbert,** Preparation of deutero-hydrocarbons, 20: 43409
**GRIMSHAW, J. A.,** Electron damage orientation effects in silicon solar cells, 20: 45018
**GRIN, Yu. T.,** Current and magnetic field of a rotating nucleus, 20: 44833
**GRISHCHUK, L. P.,** Singularities of the cosmological solutions of the gravitational equations, 20: 44107
**GRISHIN, V. G.,** Bremsstrahlung of electrons with $\bar{E}$ = 2.4 Bev, 20: 44190
**GRIVINA, P.,** Effect of $\gamma$ rays and fast neutrons on amino acid biosynthesis by Micrococcus glutamicus, 20: 42914
**GROCHOWSKI, G.,** Neutron cross sections of N, O, Al, Si, Fe, D, and Be, 20: 44661 (UNC-5139)
**GROMOV, A. V.,** Differential cross section of $^{16}O(t,\alpha)^{15}N$ and $^{16}O(t,p)^{18}O$ reactions at energy range from 0.6 to 1.75 Mev, 20: 44641 (JINR-P-2796)
**GROMOV, K. Ya.,** Investigation of the decay scheme of $^{138*}$Pr, 20: 44643 (JINR-P-2819)
**GROMOV, K. Ya.,** New data on the conversion electron spectra of $^{153}$Dy, $^{155}$Dy, and $^{157}$Dy, 20: 44639 (JINR-P-2729)
**GRONSKII, V. K.,** Development of resonance with spin $\frac{3}{2}$ in a high-energy neutrino beam, 20: 44276
**GRONSTAL, Philip T.,** Observations of the low-energy photon fluxes during the solar approach of the Ikeya-Seki comet, 20: 44158
**GROSSE, A. V.,** Containment of liquid Zr and Nb carbides on graphite between 3500 and 4700°K, 20: 43174 (NASA-CR-608)
**GROSSE, A. V.,** Prog. rpt. on high temperature inorganic chemistry, annual, 7/65–7/66, 20: 43179 (NYO-2082-6)
**GROSSE-SCHULTE, M.,** Diffraction model interpretation of heavy-ion induced transfer reactions, 20: 44757
**GROSSKREUTZ, R.,** Detection of electron avalanches with electrostatic charge images on insulated foils, 20: 43743
**GROSSMAN, L. N.,** Sintering studies and phase characterization in the system $Eu_2O_3$–$UO_2$, 20: 43853 (GEAP-5008)
**GRUHLE, W.,** Collective states of $^{107}$Ag, 20: 44782
**GRUZDEV, V. A.,** A steady-state induced discharge, 20: 44961
**GRZELAK, K.,** Effect of $\gamma$-rays on acetylcholine in insects, 20: 42874
**GSELL, R.,** Construction problems in moderator vessels, 20: 45169
**GUDDEN, F.,** Inelastic electron scattering from $^{16}$O and the radiative widths of the 6.9 and 11.5 Mev levels, 20: 44769
**GUERBET, M.,** Renal phlebography by selective angiography using ultra fluid lipiodol emulsion, 20: 43024
**GUERIN, M.,** Development of pulmonary adenomas in mice after treatment of urethane associated with x rays, 20: 42891
**GUERIN, M.,** Histogenesis of thymic lymphomas induced by whole body x irradiation in mice, 20: 42892
**GUERON, J.,** Conditions for the development of advanced type reactors in the European Community, 20: 45165
**GUETHS, J. E.,** Superconducting properties and anisotropic electrical resistivities of pure and cadmium-doped tin, 20: 44546
**GUILBOT, A.,** Action of alpha and beta amylases on irradiated starch, 20: 42798 (NP-16224)
**GUINAU, T.,** Oscillations in voltage between two weakly connected current-carrying superconductors, 20: 44561
**GUINET, Philippe,** System U–$UO_2$ above 1130°C, 20: 43931
**GULEVA, D.,** Dead time and fatigue in self-quenching G-M counters at different temperatures, 20: 43710
**GULICK, Wilson M. Jr.,** Electron spin resonance study of $^{17}$O enriched p-benzosemiquinone anion radical, 20: 43224
**GULYAMOV, U. G.,** Inelastic p-p interactions at 2.26 Bev, 20: 44189

**GUNN, James E.,** Expected number of blue-shifts and red-shifts of ejected sources, 20: 44085
**GUNNING, H. E.,** Photolysis of Group VI hydrides. I., 20: 43196
**GUNTHER, C.,** Magnetic moment of the first excited state in $^{171}$Yb, 20: 44752
**GUNYE, M. R.,** Neutron-capture $\gamma$-ray studies in $^{50}$Cr(n,$\gamma$)$^{51}$Cr, 20: 44693
**GUPTA, D.,** Plutonium supply of the German fast breeder prototype reactors, 20: 45151
**GUPTA, Raj K.,** Second order corrections to rotational spectra in deformed even even nuclei, 20: 44848
**GUREVICH, Yu. G.,** Nonlinear theory of wave propagation in semiconductors, 20: 44966
**GURVICH, A. A.,** Mitogenetic radiation of cardiac muscle of animals under normal physiologic conditions, 20: 42877
**GUSAKOW, M.,** Comparison of (d,t) and (d,$^3$He) cross sections, 20: 44794
**GUSAROV, I. I.,** Maximum permissible concentrations of thoron ($^{220}$Rn) and its daughter products in air of working premises, 20: 43603
**GUSINOW, M. A.,** Electronic recombination in He and Ar afterglow plasmas, 20: 44854 (AD-630074)
**GUSTAV, K.,** Electron-rich complexes of Y with 2,2′-dipyridyl, 20: 43258
**GUSTAV, K.,** Electron-rich complexes of La with 2,2′-dipyridyl: LaDipy$_4$, 20: 43259
**GUTFREUND, H.,** Quark model for quasars, 20: 44094
**GUTHMANN, E.,** Contribution of industry to the fast breeder project with sodium cooling, 20: 45149
**GUTIERREZ JODRA, Luis,** Technical and economic aspects of irradiated fuels, 20: 43435
**GVOZDEV, E. G.,** Glass-base dosimeters with optical density changes induced by radiation, 20: 43679
**GWALTNEY, R. C.,** Comparison of theoretical and experimental results from spherical shells with a single radially attached nozzle, 20: 43491 (ORNL-P-2472)
**GYFTOPOULOS, Elias P.,** Theoretical and experimental criteria for nonlinear reactor stability, 20: 45087
**GYGAX, Suso,** Observations of gapless superconductivity induced by metallic contact, 20: 44565

H

**HABERECHT, Rolf R.,** Anomalous effect of electron beam irradiation on silicon and germanium, 20: 44998
**HABING, D. H.,** Anomalous photocurrent generation in transistor structures, 20: 43755 (SC-DC-66-1821)
**HADDAD, E.,** Neutron capture cross section of the W isotopes from 0.01 to 10 ev, 20: 44605 (CONF-660303, pp 182-203)
**HAEFELE, W.,** Karlsruhe fast breeder project, 20: 45148
**HAEFELE, W.,** Principle of breeders, 20: 45147
**HAEHNERT, M.,** Tungsten oxide (WO$_3$): its growth and crystallographic investigations, 20: 43257
**HAEUSSER, O.,** Comparison of signs of mixing ratios to model predictions, 20: 44784
**HAGEL, Guenther V.,** Decontamination efficiency of slow sand filter action in ground water recharge, 20: 43522
**HAGEMANN, G. B.,** Determination of the gyromagnetic ratios of some odd-A deformed nuclei from branching ratio measurements, 20: 44791
**HAGEMANN, G. B.,** Vibrational states of $^{152}$Sm and $^{154}$Gd populated by the ($\alpha$,2n) reaction, 20: 44735
**HAGEN, C. R.,** Compositeness criteria for channels containing more than one elementary particle, 20: 44345
**HAGEN, J. I.,** BORAX-V neutronics, 20: 45202 (ANL-6964)
**HAGER, A.,** Albumin macroaggregates labeled with $^{99m}$Tc, 20: 43390
**HAGGMARK, L. G.,** Monte Carlo technique applied to the calculation of gamma-ray transport in compartmented structures, 20: 44987 (AD-637685)
**HAGIWARA, Hiroshi,** Catalytic hydrogen exchange of aniline on supported metal catalysts, 20: 43275
**HAHN, Eberhard,** Field functions and cardinal elements of magnet lenses, 20: 44049
**HAJEK, B.,** Formation of scandium oxide chloride phases, 20: 43260
**HAJEK, Bohumil,** Advances in scandium chemistry, 20: 43203
**HAKURA, Yukio,** Initial phase of polar cap absorptions analyzed, 20: 44472
**HALCHIN, W.,** Plasma-density measurement in a hollow-cathode arc by arc reversal, 20: 44864 (ORNL-4010)
**HALDAR, B. C.,** Isotopic exchange of bromine between acetyl bromine and labeled bromides, 20: 43247
**HALDAR, B. C.,** Recent developments in neutron activation analysis, 20: 43132
**HAMA, Mitsuru,** High energy elastic scattering and a peripheral and uncorrelated jet model, 20: 44267
**HAMA, Mitsuru,** Real amplitude in high energy elastic scattering, 20: 44384
**HAMILL, William H.,** Molecular ions in radiation chemistry. IV., 20: 43313
**HAMILL, William H.,** Molecular ions in radiation chemistry. V., 20: 43314
**HAMILTON, E. I.,** Uranium content of some international standards, 20: 43563
**HAMILTON, Edwin J. Jr.,** Secondary $\beta$-deuterium isotope effect and the cage effect in thermal decomposition of azobis-$\alpha$-phenylethane, 20: 43278
**HAMILTON, J. H.,** L subshell ratios of E2 transitions in deformed rare earth nuclei, 20: 44701
**HAMMEL, E. F.,** Dissipation and critical velocities in superfluid helium, 20: 44503 (LA-DC-8165)
**HAMRIN, C. E.,** Use of fluid bed equipment in enriched U processing, 20: 43202
**HANAI, T.,** Permeability to water of biomolecular lipid membranes, 20: 42725
**HAND, R. B.,** Purification, analysis and handling of Na and K, 20: 43083 (R-66SD3012)
**HANDA, Muneo,** Kinetic studies of oxidation of uranium iodides by oxygen, 20: 43194
**HANDEL, H.,** Shutdown equipment (AVR), 20: 45138
**HANKE, C. C.,** Stopping power of Al for 5- to 12-Mev protons and deuterons, 20: 44034
**HANKINS, Dale E.,** Effect of reactivity addition rate and of weak neutron source on fission yield of U solutions, 20: 43618
**HANKS, G. E.,** Colony-forming unit repopulation and split-dose radiosensitivity in endotoxin treated mice, 20: 42831 (AD-635600)
**HANSEN, J. W.,** Laboratory investigation of recovery processes for pitchblende residues, 20: 43420 (MCW-1508)
**HANSEN, M. F.,** Effects of x-irradiation on development of Ascaridia galli, 20: 42968
**HANSON, W. C.,** Radionuclides in Alaskan Eskimos, 20: 43622
**HANTKE, H.-J.,** Experiments with installation parts (AVR), 20: 45146
**HANTKE, H.-J.,** Startup and operation testing (AVR), 20: 45145
**HARA, M.,** Some investigations into application of pseudo-random binary signals to reactor dynamics measurements, 20: 45213
**HARAM, S.,** Versatile $^{60}$Co irradiation facility within a swimming-pool reactor, 20: 43791
**HARDE, R.,** Compact Na-cooled nuclear reactor installation at Karlsruhe (KNK), 20: 45160
**HARDE, R.,** Model studies on the prospects and consequences of the application of nuclear energy to electricity production. II., 20: 45128
**HARDING, John T.,** Method for rapidly reversing magnetic field in shorted superconducting coil, 20: 44564
**HARDY, J. R.,** Raman scattering in uranium dioxide, 20: 45015
**HARKINS, Jerome J.,** Theoretical treatment of hydrogen abstraction by hot tritium atoms, 20: 43408
**HARLAN, J. W.,** Consumer evaluations of meat products sterilized by irradiation at low temperatures, 20: 43795
**HARMER, D. E.,** Large scale applications of radiation for new materials, 20: 43792
**HARMER, David E.,** Reaction rates and physical properties in radiation graft-copolymer system, 20: 43372
**HARP, R. S.,** Pulsed transmission and ringing phenomena in a warm magnetoplasma, 20: 44944
**HARRINGTON, J.,** Use of neutron absorbers for the experimental determination of lattice parameters in subcritical assemblies, 20: 45078 (MIT-2344-6)
**HARRIS, D. R.,** Fission resonance cross section requirements for reactor design, 20: 45070 (CONF-660303, pp 823-39)
**HARRIS, David O.,** Stress intensity factors for hollow circumferentially notched round bars, 20: 43912 (UCRL-14859)
**HARRIS, John W.,** Response of isolated leukocyte lysosomes to $\gamma$ irradiation, 20: 42975
**HARRISON, G. E.,** Assessment of body content of radioactive Sr following contamination in men, 20: 42779
**HARRISON, Joan E.,** Human Ca metabolism using long-term whole body tracer measurements, 20: 42764
**HARRISON, R. W.,** Prog. rpt. on advanced refractory alloy corrosion loop program, 1–4/66, 20: 43830 (NASA-CR-72029)
**HARRISON, R. W.,** Prog. rpt. on advanced refractory alloy corrosion loop program, 4/15–7/15/66, 20: 43831 (NASA-CR-72057)
**HART, Roger G.,** Modeling the chromosome, 20: 45243 (UCRL-14625 (Rev.1))
**HARTE, C.,** Dependence of somatic mutation spectrum of Ephestia kuehniella of irradiated animal, 20: 42970
**HARTE, J.,** Bootstrap solutions to the Bethe-Salpeter equation, 20: 44197
**HARTILL, D.,** $\bar{p}$p elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263
**HARTLEY, S.,** Strain-aging in tantalum, 20: 43922
**HARTWIG, Manfred,** Ozone concentrations in uv irradiation rooms, 20: 43011
inelastic proton scattering, 20: 44658 (UCRL-16984)
**HARVEY, B. G.,** Test of a microscopic description of nickel isotopes by
**HASHER, B. A.,** Dynamic polarization of protons in radiation-damaged polyethylene by the solid effect, 20: 45024

**HASKO, S.,** Prog. rpt. on ceramic materials for reactor applications, 7/61–6/62, 20: 43900 (NBS-D-150)

**HASKO, S.,** Prog. rpt. on ceramic materials for reactor application, 7/62–6/63, 20: 43901 (NBS-D-154)

**HASLAM, John L.,** Equilibrium and kinetic $D_2O$ solvent isotope effects involving N...H–O and N–H...O intramolecular H bonds, 20: 43287

**HASSERJIAN, G.,** Electromagnetic-field solution of a diffuse plasma boundary, 20: 44897

**HASSLER, O.,** Microangiographic studies on changes in cerebral vessels after irradiation. I., 20: 42862

**HATADA, Motoyoshi,** Correlations of structural unit of organic compounds with G values of their radiolytic products, 20: 43296

**HAUCK, H.,** Irradiation behavior of tempered Ni–Cr–Fe alloy, 20: 44013

**HAUSER, J. J.,** Effect of a magnetic film coating on the superconducting surface sheath of a type-II superconductor, 20: 44524

**HAUSER, Ulrich,** Elastic scattering of 0.5-Mev gamma rays by heavy elements, 20: 44829

**HAUSNER, Henry H.,** Conference on modern developments in powder metallurgy, New York, 6/65, 20: 43822

**HAWKING, S. W.,** Singularities in the universe, 20: 44492

**HAWKINS, James N.,** Particle-size distribution of low-density plasma lipoproteins, 20: 42717 (UCRL-16246, pp 176-85)

**HAWLEY, C. A. Jr.,** Electronic data processing method assessment of potential off-site radiological effects, 20: 43609

**HAWLEY, J. P.,** Effects of prepoison cross section of uncertainties on SNAP reactor performance, 20: 45193 (CONF-660303, pp 204-9)

**HAWTHORNE, J. R.,** Prog. rpt. on irradiation effects on reactor structural materials, 8–10/65, 20: 43997 (NRL-Memo-1663)

**HAYASHI, K.,** Studies on radiation-induced ionic polymerization. I., 20: 43308

**HAYASHI, K.,** Studies on radiation-induced ionic polymerization. III., 20: 43338

**HAYASHI, K.,** Studies on radiation-induced ionic polymerization. IV., 20: 43339

**HAYASHI, Koichiro,** Electron spin resonance study of radiation-induced solid-state polymerization of conjugated dienes, 20: 43325

**HAYASHI, Shuhei,** Activation analysis of cancer, 20: 43138

**HAYDON, D. A.,** Permeability to water of biomolecular lipid membranes, 20: 42725

**HAYDT, Heliton M.,** Fabrication of $UO_2$ fuel elements for the Re-Suco subcritical assembly, 20: 43872

**HAYDT, Heliton M.,** Production of metallic uranium and thorium, 20: 43871

**HAYES, D. W.,** Rare earth distribution in waters of Gulf of Mexico, 20: 43087 (TID-23295, Sect. 4)

**HAYES, R. E.,** Influence of charge effects on the electrical conductivity of thin metal films, 20: 44510

**HAYES, Thomas L.,** Particle-size distribution of low-density plasma lipoproteins, 20: 42717 (UCRL-16246, pp 176-85)

**HAYES, Thomas L.,** Virus particles associated with immune responses in Ehrlich ascites tumor cells, 20: 42712 (UCRL-16246, pp 51-7)

**HAYES, Wesley N. Jr.,** Remotized bolt cutter, 20: 43470 (UCRL-14743)

**HAYNER, C. T.,** Data processing applications to a large, dual-purpose nuclear reactor, 20: 45191 (RL-GEN-1058)

**HAZEL, Joseph J.,** Curve relating dose in time to pituitary histologic change following $\alpha$ irradiation, 20: 43016 (UCRL-16246, pp 58-65)

**HEAL, T. J.,** Oxide fuels: how U. K. will fill the need, 20: 43874

**HEATH, R. L.,** Prog. rpt. on gamma-ray spectrometry of neutron-deficient isotopes, annual, 1965, 20: 44634 (IDO-17188)

**HEBARD, James F.,** Prog. rpt. on element and energy transfer in lower trophic levels in marine environment, 4/63–3/66, 20: 42731 (RLO-1751-2)

**HEDGECOCK, J. L.,** Weight scaling factors for SNAP reactor shields, 20: 45197 (NAA-SR-Memo-11971)

**HEDGES, Dorothea H.,** Zirconium analysis of sea water, 20: 43088 (TID-23295, Sect. 5)

**HEDVALL, P.,** Enhancement of acoustic-electromagnetic wave coupling across a plasma-air boundary, 20: 44908

**HEER, W.,** Slightly enriched uranium single-rod heavy-water lattice studies, 20: 45084

**HEFFT, Klaus,** Relations between the electromagnetic form factors of the $0^{-}$- and $1^{-}$-mesons from the collinear groups $SU(3) \otimes SU(3) \otimes U(1)$ and $SU(6)_W$, 20: 44394

**HEGAZY, A. H. T.,** Effect of gibberellic acid on phosphate availability in Vicia faba seedlings. II., 20: 42771

**HEGER, A.,** Modification of polyamide fibers by energetic $^{60}$Co $\gamma$ radiation, 20: 43331

**HEIDT, H. M.,** Use of fluid bed equipment in enriched U processing, 20: 43202

**HEIKKINEN, D. W.,** Collective states of $^{107}$Ag, 20: 44782

**HEILIGMAN, Fred,** Consumer evaluations of meat products sterilized by irradiation at low temperatures, 20: 43795

**HEINRICH, H.-J.,** Experience on a 2 Mev Van de Graaff accelerator in radiation-chemical works, 20: 43328

**HEITKAMP, D.,** Effect of alpha bombardment on the diffusion of lead in silver, 20: 44002

**HELD, Ch.,** Contribution of industry to the fast breeder project with sodium cooling, 20: 45149

**HELLER, M. B.,** Procedure for calculation of gonadal x-ray dose in diagnostic radiography, 20: 43026

**HEMKE, Stefanie,** Effects of ionizing radiation on ultramicroscopic structure of photoreceptors, 20: 42958

**HEMMIG, P. B.,** Conference on neutron cross section technology, Washington, D. C., 3/66, 20: 44603 (CONF-660303)

**HENDERSON, W. B.,** Program AVOID, NMP-838: FORTRAN IV program for evaluating equivalent diffusion coefficient and loss cross section of an annular void in cylindrical reactors, 20: 45072 (GEMP-424)

**HENDRIE, D. L.,** Test of a microscopic description of nickel isotopes by inelastic proton scattering, 20: 44658 (UCRL-16984)

**HENLEY, E. M.,** General comment concerning the J dependence of direct reaction cross sections, 20: 44773

**HENNING, W.,** Magnetic properties of the $K = \frac{1}{2}$ rotational band of $^{171}$Yb, 20: 44753

**HENNINGS, U.,** Safety questions and safety devices (AVR), 20: 45143

**HENRY, R.,** Comparative evaluation of oophorectomy and radiation castration according to excretion of urinary gonadotropins, 20: 43044

**HENRY, W. M.,** Use of tri-iso-octylamine as anion exchanger for partition chromatography, 20: 43439

**HENTZ, Robert R.,** Reaction of isopropylbenzene on $\gamma$-irradiated silica gels, 20: 43319

**HERBELL, Thomas P.,** Structure and properties of tungsten-base powder metallurgy composites, 20: 43899 (NASA-TN-D-3610)

**HERBER, R. H.,** Moessbauer spectrometer calibration using $^{57}$Fe enriched metallic iron, 20: 43707

**HERMAN, R. M.,** Finite nuclear mass effects on the centrifugal stretching constant in $H^{35}Cl$, 20: 44123

**HERNQVIST, Karl G.,** Thermionic energy converter, 20: 44170

**HEROD, James V.,** Computational model for geomagnetically trapped particle shells and kinematic parameters, 20: 44416 (AD-639436)

**HERRMANN, Christoph,** Group-theoretical approach to the pairing interaction in the translationally invariant shell model, 20: 44699

**HERZOG, S.,** Electron-rich complexes of Y with 2,2′-dipyridyl, 20: 43258

**HERZOG, S.,** Electron-rich complexes of La with 2,2′-dipyridyl: $LaDipy_4$, 20: 43259

**HEUSINGER, H.,** Effect of protecting components on radiation chemical reactions of polymer molecules, 20: 43355

**HEWKA, P. V.,** Nuclear structure of $^{16}$N, 20: 44730

**HEYNE, Werner,** Precipitation of uranium dioxide from alkali chloride melts, 20: 43185 (ZFK-WF-25)

**HICKMAN, B. S.,** Analytical description of growth of beryllium oxide during neutron irradiation, 20: 43985 (AAEC-TM-318)

**HICKMAN, B. S.,** Behavior of beryllium oxide-based dispersion fuels, 20: 44014

**HIEBERT, J. C.,** Distorted wave predictions of observed J dependence in the (d,$^{3}$He) reaction, 20: 44800

**HIEKMANN, S.,** Experience with automatic deflector for Rossendorf cyclotron, 20: 44050

**HIGHLAND, V.,** Observation of x-rays from spark discharges in a spark chamber, 20: 43714

**HILAIRE, M.,** Purification and separation of $^{95}$Zr and $^{95}$Nb, 20: 43433

**HILDITCH, R. J.,** Behavior of beryllium oxide-based dispersion fuels, 20: 44014

**HILL, D. A.,** Dynamic polarization of protons in radiation-damaged polyethylene by the solid effect, 20: 45024

**HILL, H. W.,** Sintering studies and phase characterization in the system $Eu_2O_3–UO_2$, 20: 43853 (GEAP-5008)

**HILL, John C.,** Decay of $^{145}$Eu, 20: 44845

**HILL, N. W.,** Differential cross sections for production of protons in reactions of 160-Mev protons on complex nuclei, 20: 44649 (ORNL-3887)

**HILL, R.,** Relationships between light output and energy resolution in Tl activated sodium iodide crystals, 20: 43704

**HILL, R. A.,** Test of the theory of Stark broadening of $H_\beta$, 20: 44943

**HILL, R. M.,** Observation of cyclotron echoes from a highly ionized plasma, 20: 44936

**HILLOVA, Jana,** Relative dosimetric measurements of a well irradiator, 20: 43613

**HINDEL, Robert,** Apparatus and method for determination of fluid volume by radioactive dilution techniques, 20: 43054

**HINNOV, Einar,** Temperatures of neutral atoms in C-stellarator discharges and charged-particle temperatures of the afterglows, 20: 44911

**HINTZ, N. M.,** Three $L = 0$ transitions in the $^{57}$Fe(p,t)$^{55}$Fe reaction, 20: 44756

**HINZPETER, A.,** Beta spectrometer with liquid scintillator for samples of dry powder with low specific activity, 20: 43682

**HIRAOKA, Eiichi,** Gamma-induced conductivity in insulating polymers. II., 20: 44997

**HIROKAMI, Shunichi,** Intersystem crossing of electronically excited dideuteroethylene molecules formed in benzene photosensitization, 20: 43197

**HIROSHIGE, Noboru,** Two-pion-exchange potential with nucleon pairs, 20: 44271

**HIROTA, Kozo,** Correlations of structural unit of organic compounds with G values of their radiolytic products, 20: 43296

**HIRSCHBERG, Joseph G.,** Temperatures of neutral atoms in C-stellarator discharges and charged-particle temperatures of the afterglows, 20: 44911

**HIRTH, W.,** Continuous thermal radio emission of a plasma layer in the region of the plasma frequency, 20: 44883

**HIVERT, V.,** Point defects by neutron bombardment in iron containing impurities, 20: 45039

**HO, James C.,** Calorimetric investigation of superconductivity in alpha uranium, 20: 44504 (UCRL-17026)

**HO, James C.,** Heat capacity of alpha U at a pressure of 10 kbar, between 0.3 and 6°K, 20: 44557

**HOBBS, G.,** Radiation preservation of fish in developing countries, 20: 43775

**HOBSON, D. O.,** Effect of alloying elements on the strength, stability, and corrosion and oxidation resistance of Nb, 20: 43905 (ORNL-3212)

**HODGSON, P. E.,** Analysis of the reactions $^{25}$Mg(p,p)$^{25}$Mg and $^{24}$Mg(d,p)$^{25}$Mg at 5 and 6 Mev, 20: 44737

**HODGSON, P. E.,** Fluctuations of the cross sections of the reactions $^{25}$Mg(p,p)$^{25}$Mg and $^{24}$Mg(d,p)$^{25}$Mg, 20: 44738

**HOEGAASEN, H.,** ρ′ trajectory and its contribution to NN and πN charge exchange scattering, 20: 44222

**HOENIG, Arnost,** Equivalent material thicknesses for gamma radiation attenuation, 20: 44989

**HOFFERT, F.,** Influence of nature and energy of ion beam on gain of electron multiplier, 20: 43659

**HOFFMAN, D. C.,** Beta decay of cerium isotopes far to the neutron-rich side of stability, 20: 43419 (LA-DC-7869)

**HOFFMAN, J.,** Electron collision frequency versus charged particle seeding, 20: 44851 (AD-628777)

**HOFMANN, F.,** Measurement of nonelastic cross section for Pb at 2.1 and 1.7 Mev, 20: 44618 (CONF-660303, pp 726-34)

**HOGERTON, John F.,** Outlook for central-station nuclear power in the United States, 20: 45175

**HOKKYO, Noboru,** Radiationless condition and renormalization, 20: 44380

**HOLBROW, C. H.,** Analog states in $^{55,57}$Co and $^{59,61}$Cu excited by ($^{3}$He,d) reactions, 20: 44837

**HOLBROW, C. H.,** Continuous neutron spectra from (p,n) reactions, 20: 44739

**HOLBROW, C. H.,** Nuclear structure of $^{16}$N, 20: 44730

**HOLLAND, R. W.,** Comparison of theoretical and experimental results from spherical shells with a single radially attached nozzle, 20: 43491 (ORNL-P-2472)

**HOLLANDER, J. M.,** Semiconductor revolution in nuclear radiation counting, 20: 43737

**HOLLINGHURST, R.,** Radiation-resistant fluids and lubricants, 20: 43493

**HOLLOWAY, D. F.,** Formation of channeling patterns on the surface of ion bombarded silicon, 20: 45022

**HOLM, Dale M.,** Interference reduction and sensitivity improvement in activation analysis, 20: 43075 (LA-DC-7931)

**HOLMBERG, Peter,** Reaction $^{31}$P(p,γ)$^{32}$S in the proton energy region 800–1160 kev, 20: 44822

**HOLT, E. H.,** Radiation-temperature measurements on the nitrogen afterglow plasma, 20: 44942

**HOLTZMAN, Richard B.,** Lead-210 and $^{210}$Po in tissues of cigarette smokers, 20: 42952

**HOLTZMAN, Richard B.,** Natural levels of $^{210}$Pb, $^{210}$Po and $^{226}$Ra in humans and biota of Arctic, 20: 43005

**HOLYNSKI, R.,** Central collisions of nucleons with heavy nuclei for energy higher than 10$^{12}$ ev, 20: 44286

**HOLZHEY, J.,** Continuous gamma-ray control of hot rolled ingots before cutting, 20: 43870

**HOMER, J.,** Improving signal-to-noise ratio of NMR spectra, 20: 43640

**HONECKER, G.,** Loading device (AVR), 20: 45139

**HONIG, Carl R.,** Amount and distribution of $^{86}$Rb transported into myocardium from ventricular lumen, 20: 42749

**HOOD, D. W.,** Rare earth distribution in waters of Gulf of Mexico, 20: 43087 (TID-23295, Sect. 4)

**HOOD, Donald W.,** Neutron activation analysis of Ru in sea water, 20: 43086 (TID-23295, Sect. 3)

**HOOD, Donald W.,** Prog. rpt. on chemistry and analysis of trace metals in sea water, final, 2/61-1/66, 20: 43084 (TID-23295)

**HOOD, Donald W.,** Zirconium analysis of sea water, 20: 43088 (TID-23295, Sect. 5)

**HOPKINSON, Eric C.,** Ion accelerator, 20: 44068

**HOPP, D. I.,** Use of the 3/2-radial resonance in extraction from a six-sector isochronous cyclotron, 20: 44054

**HORAK, Jindrich,** Chromosome aberrations: increased incidence in bone marrow of irradiated rats, 20: 42951

**HORI, Shoichi,** Fundamental triplet and its new degree of freedom, 20: 44376

**HORIGUCHI, Y.,** Formation of tungsten and aluminum carbides by explosive shock, 20: 43952

**HORNUNG, Guenter,** Behavior of kidney-, liver-, and serum esterase of rats following irradiation, 20: 42824

**HORNUNG, Guenter,** Radiation sensitivity of rats in state of hyperthermia, 20: 42959

**HORTIG, G.,** Average charge of stripped heavy ions, 20: 44136

**HORTON, George K.,** Nuclear magnetic resonance local-magnetic-field shift in solid xenon, 20: 44143

**HORWITZ, L.,** Consequences of an approximate $C_V$ invariance of the physical hadrons, 20: 44367

**HORWITZ, L.,** Possible vanishing of strong interaction cross-section at infinite energies, 20: 44206

**HOSANGDI, R. R.,** Nuclear spectroscopic studies of $^{101}$Mo → $^{101}$Tc → $^{101}$Ru decay chain using chemically separated activities, 20: 44817

**HOSKINS, R. E.,** Core design and containment cost study for gas-cooled fast reactor studies, 20: 45117 (ORNL-TM-1194)

**HOU, Hua-sheng,** Radiation for automatically controlling level of liquid metal in crystallizer when steel is cast, 20: 43761

**HOURTOULLE, F. G.,** Comparative evaluation of oophorectomy and radiation castration according to excretion of urinary gonadotropins, 20: 43044

**HOUSTON, John M.,** Energetics 4: thermionic power, 20: 44168

**HOUTMAN, Johannes Paulus Willem,** Method for electrolytic production of uranium dioxide crystals, 20: 43266

**HOWELLS, H.,** Discharge of low-activity radioactive effluent from Windscale works into the Irish sea, 20: 45229

**HOWIE, A.,** Diffraction channelling of fast electrons and positrons in crystals, 20: 44134

**HOWIE, A.,** Measurements of extinction distance and absorption of high-energy electrons in crystals, 20: 45014

**HOYER, Bill H.,** Thermal stabilities and species specificities of reannealed animal DNA, 20: 42757

**HOYER, F.,** Determination of absolute activities of β radiation using Geiger-Mueller counting tubes, 20: 43697

**HOYLE, F.,** Conformal theory of gravitation, 20: 44497

**HRASKO, P.,** Anomaly of small angle neutron scattering by $^{238}$U, 20: 44764

**HRUSCHKA, A. A.,** Spark chamber for gamma-ray astronomy, 20: 43734

**HRYNKIEWICZ, A. Z.,** Magnetic hyperfine structure of the $^{57}$Fe impurity nucleus, 20: 45033

**HRYNKIEWICZ, H. U.,** Magnetic hyperfine structure of the $^{57}$Fe impurity nucleus, 20: 45033

**HUBER, P.,** Seventh report of federal commission for monitoring of radioactivity, 1963, 20: 43519

**HUCK, P. J.,** Improving signal-to-noise ratio of NMR spectra, 20: 43640

**HUDOKLIN, A.,** Spectrometer for 14 Mev neutron capture spectroscopy, 20: 43708

**HUDSON, H. S.,** Auroral-zone microbursts, 20: 44453

**HUGHES, D. E.,** Ultraviolet radiation and Moraxella bovis in etiology of bovine infectious keratoconjunctivitis, 20: 42863

**HUGHES, L. B.,** Level structure of $^{104}$Rh observed in thermal neutron capture, 20: 44690

**HUGHES, L. B.,** Reaction $^{59}$Co(n,γ)$^{60}$Co, 20: 44729

**HUGUET, Michel,** High energy γ radiation by means of high resolution pair spectrometer, 20: 43684

**HULL, Andrew P.,** Environmental monitoring of $^{131}$I comparisons with meteorological calculations, 20: 43608

**HULL, D.,** Effect of stress on strain ageing, 20: 43965

**HULTQVIST, Bengt,** Ionospheric absorption of cosmic radio noise, 20: 44478

**HUME, David M.,** Method of inducing specific lymphopenia in dogs, 20: 42902

**HUMMEL, Dieter O.,** Recent results on the γ-radiation-induced polymerization of some vinyl monomers in emulsion systems, 20: 43374

**HUMMEL, Harry H.,** Sensitivity of fast reactor parameters to cross section uncertainties, 20: 45069 (CONF-660303, pp 809-20)

**HUNEKE, J. C.,** Trapping of the solar wind in solids. I., 20: 44697

**HUNGATE, F. P.,** Radionuclides in Alaskan Eskimos, 20: 43622

**HUNZIKER, Walter,** Spectra of Schroedinger multiparticle Hamiltonians, 20: 44484

**HURIA, H. C.,** Physics studies of prototype power reactor project, 20: 45104 (AEET-239)

**HURLEY, Charles A.,** ASTRON mechanical engineering design effort, 20: 44868 (UCRL-70027)

**HURST, J. S.,** Machinability of some infrequently used materials, 20: 43864 (Y-1550)

**HUSCHKA, H.,** Fuel development for a high-temperature fast reactor, 20: 45100

**HUSMANN, D.**, Single photoproduction of neutral $\pi$-mesons on hydrogen at small angles between 1.3 and 3 Bev, 20: 44242

**HUTCHINS, B. A.**, User requirements for cross sections in the energy range from 100 ev to 100 kev, 20: 45092

**HUTH, Gerald C.**, Radiation detection which employs semiconductor avalanche amplification and tunnel diode element, 20: 43677

**HWANG, C. F.**, Dynamic polarization of protons in radiation-damaged polyethylene by the solid effect, 20: 45024

**HWANG, R. N.**, Chemical binding effects on resonance line shapes of $^{238}$U in $UO_2$ lattice, 20: 45064 (CONF-660303, pp 134-45)

**HYDE, B. G.**, Praseodymium–oxygen system, 20: 43967

**HYDER, M. Lee**, Dissolution of thorium oxide, 20: 43412 (DP-1044)

## I

**IALONGO, G.**, Semimicroscopic description of even Hg spectra, 20: 44788

**IANNI, P. W.**, EVESR Mark III superheat fuel bundle design, 20: 45110 (GEAP-4793)

**IBA, Shozo**, Effects of $\gamma$ irradiation on tulip. II., 20: 42861 (NSJ-tr-53)

**IBRAGIMOV, Sh. Sh.**, Influence of neutron radiation on some properties of refractory concretes, 20: 44005

**ICHIKAWA, Yoshi H.**, Thermodynamic properties of an electron plasma, 20: 44955

**IDA, Masakuni**, Behavior of elastic scattering amplitudes at high energies, 20: 44374

**IFEROV, G. A.**, Use of semiconductor counters of type p-l-n for study of nuclear reactions, 20: 43741

**IGNAT'EVA, M. I.**, Radiation-induced colors in deformed alkali-halide crystals, 20: 45041

**ILCEWICZ, Frank H.**, Lead-210 and $^{210}$Po in tissues of cigarette smokers, 20: 42952

**IL'IN, L. A.**, Mass-spectrometric method of analysis of isotope content of O in phosphates and $H_2O$, 20: 43146

**IMMEL, H.**, Preparation and radioactive synthesis of $\gamma\gamma$ dimethyl-allyl-pyrophosphate, 20: 43407

**INABA, Gohzoh**, Proof of the formula for the Rossi-$\alpha$ method, 20: 45083

**INADA, Goro**, Central regulation of electrocardiogram and its relation to x-ray irradiation of the head, 20: 42925

**INCH, W. R.**, Current trends in radiobiology, 20: 42821

**INDREAS, Gr.**, Transformation of the proton source of an U-120 cyclotron for negative hydrogen ion production, 20: 44056

**INGELS, S. E.**, Forming techniques for Be alloys, 20: 43856 (NASA-TM-X-53453(Vol.2))

**INGELS, S. E.**, Joining techniques for Be alloys, 20: 43859 (NASA-TM-X-53453)

**INGELS, S. E.**, Surface treatments for Be alloys, 20: 43857 (NASA-TM-X-53453(Vol.4))

**INGELS, S. E.**, Thermal treatments for Be alloys, 20: 43858 (NASA-TM-X-53453(Vol.5))

**INMAN, M. C.**, Prog. rpt. on electron transmission study of oxide particle statistics in TD-nickel alloy, 5/65–4/66, 20: 43882 (AD-636487)

**INOUE, Miyako**, Radiochemical polymerization of acrylonitrile in crystallized state, 20: 43277

**INOUE, Yasushi**, Chemistry of Pa. II., 20: 43431

**IONESCO-PALLAS, Nicolas J.**, Addition to the hyperfine structure theory, 20: 44695

**IORI, I.**, Finite range of data errors affecting the analysis of a fluctuating excitation function, 20: 44745

**IPATKIN, I. S.**, Soft x-ray detector for the 1 to 12 A range, 20: 43726

**IRELAND, D. R.**, Effects of aging on dissimilar metal welded joints with multipass welding of Hastelloy X and Hastelloy W filler metal, 20: 43888 (BNWL-290(Pt.1))

**IRMER, J.**, Production of stationary plasma beams by means of a glow discharge at normal pressures, 20: 44900

**IRVING, D. C.**, Adjoint Monte Carlo calculations for enriched U metal assemblies, 20: 45076 (K-DP-1637)

**ISAAC, Elsa L.**, Whole-body counting of $^{47}$Ca and $^{35}$Sr, 20: 42744 (UCRL-16246, pp 19–35)

**ISEBECK, K.**, Stored energy, volume, and resistivity change in neutron-irradiated Al, 20: 45037

**ISHIDA, Ryoei**, Spectrophotometric determination of Y with Chromazurol S, 20: 43110

**ISHIGURO, Yukio**, Group constants for a fast reactor and sodium void effects, 20: 45075 (JAERI-1109)

**ISHIKAWA, M.**, KINAK: A code for one-dimensional, nuclear, thermal, and hydraulic calculation for BWR, 20: 45074 (JAERI-1107)

**ISHIMURA, Tsutomu**, Echelle monochromator and application to ion temperature measurement of He plasma, 20: 44920

**ISHIYAMA, T.**, Dehydration of radioactive slimes, 20: 45218 (KFK-tr-201)

**ISOYA, Toshiro**, Correlations of structural unit of organic compounds with G values of their radiolytic products, 20: 43296

**ISRAEL, Werner**, Is gravitational collapse really irreversible?, 20: 44082

**ITO, Nobuo**, Observations of fallout in Tokyo. II., 20: 43518 (NSJ-tr-54)

**ITO, Rinsuke**, Angular distribution of backscattered electrons and backscattering coefficient, 20: 44115

**ITO, Rinsuke**, Energy distribution of backscattered electrons. II., 20: 44116

**ITO, T.**, KINAK: A code for one-dimensional, nuclear, thermal, and hydraulic calculation for BWR, 20: 45074 (JAERI-1107)

**ITO, Yukio**, K-$\pi$ resonances and the $\mu$ polarization in $K_{u_4}$, 20: 44270

**ITURRIAGA, H.**, Reactivity and possible applications of imidodioximes: maleimide dioxime and 1,2,3,6-tetrahydrophthalimide dioxime, 20: 43095

**IVANCHENKO, Yu. M.**, Electrodynamics of the Josephson effect, 20: 44571

**IVANCHENKO, Yu. M.**, Tunneling between two superconductors, 20: 44573

**IVANOV, K. I.**, Scattering of slow neutrons by ortho- and parahydrogen, 20: 44591

**IVANOV, V. A.**, Ionization measurements in streamer chamber, 20: 43691

**IVANOV, V. I.**, Radiation genetics of Arabidopsis thaliana (L.) heynh. I., 20: 42900

**IVANOV, Yu. M.**, Mass-spectrometer outfit for studying intensity distribution of molecular beams in space, 20: 43658

**IVANOV-KHOLODNYI, G. S.**, Variation in the ionic composition of the atmosphere at altitudes of 100 to 200 km, 20: 44462

**IVANOVSKII, N. N.**, Leakage discovery in Na–$H_2O$ steam generator, 20: 45059

**IVENS, G.**, Physics of the AVR Reactor, 20: 45144

**IVKOVIC, Magdalena**, Standard graphite block, 20: 45060

**IWAKAMI, Minoru**, Peroxides as factor of atherosclerosis, 20: 42813

**IWAMOTO, J.**, Comparative metabolism of Cs and K in mammals, 20: 42768

**IWAO, H.**, Level of protein intake on alteration of liver composition in irradiated rat, 20: 42864

**IWASHIMA, Kiyoshi**, Distribution of Cs and Rb in human blood, 20: 42778

**IWASHIMA, Kiyoshi**, Environmental contamination with $^{95}$Zr–$^{95}$Nb in Japan, 20: 43615

**IWASHITA, Fumio**, Neutron generator, 20: 44600

**IYA, V. K.**, Preparation of special radioisotope labeled compounds at Trombay, 20: 43397

**IYA, V. K.**, Preparation of useful radioisotopes of high specific activity, 20: 43398

**IYA, V. K.**, Preparation of $^{51}$Cr of high specific activity for medical use, 20: 43401

**IYER, R. S.**, Isomeric cross-section ratios in the $(n,\gamma)$ reaction on $^{76}$Ge and $^{82}$Se, 20: 44816

**IZMAILOVA, G. M.**, Morphological changes in innervation system of meninges in dogs with radiation sickness, 20: 42881

## J

**JABLONSKA, Jadwiga**, Progress in reactor detectors design and construction, 1963–1965, 20: 43716

**JACIMOVIC, Ljubodrag**, Production of $^{131}$I, 20: 43404

**JACKLYN, R. M.**, Two-way sidereal anisotropy in charged primary cosmic radiation, 20: 44159

**JACKSON, H. E.**, Properties of partial radiation widths in $^{196}$Pt, 20: 44807

**JACKSON, J. L.**, Effect of oxidation, thermal cycling, and irradiation on Si coated graphite, 20: 43825 (BNWL-242)

**JACOBS, G.**, Properties of color centers in CsBr single crystals irradiated at liquid-He temperature, 20: 45036

**JACQUELIN, Marc-Henri**, Consideration on some measurements made on electric arc plasma generators, 20: 44925

**JACQUEMIN, A.**, Nonuniqueness of N/D solutions for singular potentials, 20: 44347

**JACQUEMIN, J.**, Measurement and control devices of the loading installation (AVR), 20: 45140

**JADHAV, A. V.**, Mass yields of $^{99}$Mo, $^{105}$Rh, and $^{132}$Te in the spontaneous fission of $^{238}$U, 20: 44815

**JAECH, J. L.**, Sodium mass transfer. XIV., 20: 43826 (GEAP-4830)

**JAFFE, Arthur M.**, Form factors at large momentum transfer, 20: 44257

**JAMERSON, F. E.**, Electron density maximization in a Penning gas mixture ionized by fission fragments, 20: 44933

**JAMES, D. B.**, Processing of Pu by ion exchange. VIII., 20: 43418 (LA-3534)

**JANCA, J.**, Time dependence of intensities of $N_2(C^3\pi–B^3\pi)$-bands in pulsed flare discharges, 20: 44884

**JANIKOWSKI, Andrzej**, Progress in reactor detectors design and construction, 1963–1965, 20: 43716

**JANKOVIC-ZAGORCIC, A.**, Radiodecontamination of skin by ultrasonics, 20: 42811

**JANOUT, Z.**, Phase-shift analysis of nucleon-nucleon scattering at 400 Mev, 20: 44191

**JANSEN, P.**, Plutonium supply of the German fast breeder prototype reactors, 20: 45151

inelastic proton scattering, 20: 44658 (UCRL-16984)

**JARVIS, O. N.**, Test of a microscopic description of nickel isotopes by

**JAVELLAUD, Jean,** Cryogenic equipment, 20: 44501 (CEA-R-3008)
**JAYARAMAN, A.,** Many more superconducting bismuth phases, 20: 44554
**JAYARAMAN, H.,** Solvent isotope effects in amide hydrolysis, 20: 43280
**JEANMAIRE, Lucien,** Simplified method for the determination of $^{90}Sr$ in large amounts of bone ash, 20: 43061 (CEA-R-2998)
**JEFFREY, A.,** Magnetohydrodynamic stability and thermonuclear containment, 20: 44986
**JELLEY, J. V.,** Absorption of high-energy gamma-rays within quasars and other radio sources, 20: 44084
**JENGO, R.,** New family of sum rules from current algebra, 20: 44362
**JENKINS, I. L.,** Recovery of uranium from Zircaloy--uranium alloy, 20: 43438
**JENNI, H. P.,** Inspection window with grooved metallic seal: problem in the nuclear reactor sector, 20: 45062
**JENSEN, Per,** Crystal structures of $Mo_2As_3$ and $W_2As_3$, 20: 43187
**JENSEN, S. E.,** Effects of metal--water reactions on the loss-of-coolant accident, 20: 45112 (IDO-17168)
**JENSEN, T. Skov,** Acute gastric ulcers induced by radiation, 20: 43019
**JENSON, D. K.,** Environmental effects from operation of the waste calcination facilities, 20: 45219
**JHA, J. C.,** Studies on Cs sorption properties of some Indian vermiculites, 20: 43130
**JNANANANDA, Swami,** Lifetimes of 158 and 208 kev. Levels of $^{199}Hg$, 20: 44704
**JOERGENSEN, Chr. Klixbuell,** Absorption spectra of octahedral lanthanide hexahalides, 20: 43231
**JOERGENSEN, P. Bruun,** Isobaric analogue states from proton excitation of medium-weight even nuclei, 20: 44761
**JOESTLEIN, H.,** Anomalous magnetic moment of the negative muon, 20: 44207
**JOHANSSON, E.,** Neutron spectrum in a $UO_2$ tube at different temperatures, 20: 45089
**JOHNSEN, R. H.,** Radiolysis of ethyl mercaptan, 20: 43320
**JOHNSON, C. H.,** Differential scattering of neutrons from oxygen and intermediate states, 20: 44651 (ORNL-P-2434)
**JOHNSON, C. M.,** Economic use of nuclear power in expanding utility systems, 20: 45178
**JOHNSON, Clarence L.,** Effects of simulated altitude on iodine metabolism. I., 20: 42745 (UCRL-16246, pp 126-37)
**JOHNSON, Irving,** Thermodynamics of dilute solutions of plutonium in liquid magnesium, 20: 43819
**JOHNSON, Raymond H. Jr.,** Soil and sediment analysis: for environmental radiation surveillance, 20: 42733
**JOHNSTON, A. R.,** $T = 2$ isobaric multiplet at mass 24, 20: 44758
**JOHNSTON, I. D.,** Radio propagation in the solar gravitational field, 20: 44096
**JOHNSTON, R. C.,** Status rpt. on Karachi Nuclear Power Project, 20: 45101 (66-CNA-305)
**JOHNSTON, Tudor Wyatt,** General spherical harmonic tensors in the Boltzmann equation, 20: 44914
**JOLDERSMA, T.,** Evidence against the existence of a strangeness +2 meson resonance at a mass of 1280 Mev, 20: 44262
**JOLOS, R. V.,** Method for solving the nucleon-phonon interaction problem, 20: 44678
**JONES, C. M.,** Search for the trineutron, 20: 44809
**JONES, C. M.,** Search for the trineutron, 20: 44650 (ORNL-P-2412)
**JONES, G. E.,** Transition radiation and low-energy bremsstrahlung from silver and aluminum foils bombarded by grazing-incidence electrons, 20: 44111 (ORNL-TM-1571)
**JONES, J. M.,** Source of error in plasma electron oscillation measurements, 20: 44940
**JONES, John E.,** Identification of thyroidal iodoamino acids by gel filtration and automated $^{127}I$ determination, 20: 42774
**JONES, Owen C. Jr.,** Condensation heat transfer at an agitated, steam--water interface, 20: 43477 (CONF-661102-1)
**JONES, W. D.,** Plasma-density measurement in a hollow-cathode arc by arc reversal, 20: 44864 (ORNL-4010)
**JONSSON, E.,** Neutron spectrum in a $UO_2$ tube at different temperatures, 20: 45089
**JORDAN, Willard C.,** Resolution of x-ray sources at low galactic longitude, 20: 44091
**JORDANOV, N.,** Photometric Ce determination in cast Fe and alloyed steel with help of tetron, 20: 43143
**JOSHI, G. C.,** Tagging of hippuran with radioiodine ($^{131}I$), 20: 43403
**JOSHI, S. B.,** Adsorption of tracers on glass, 20: 43251
**JOUTHAS, J. T.,** Latent heat of vaporization and vapor pressure of Na, 20: 43884 (AGN-8191(Vol.1))
**JOZUKA, Kenji,** Absorption and excretion of Ca by teleost fishes, 20: 42750
**JUGUET, B.,** Importance of mud and suspended matter in transport and elimination of radionuclides contained in surface waters, 20: 43544
**JULIEN, J.,** Properties of partial radiation widths in $^{196}Pt$, 20: 44807
**JULL, E. V.,** Enhancement of acoustic-electromagnetic wave coupling across a plasma-air boundary, 20: 44908
**JUNG, E. A.,** Solid state nanosecond pulser using Marx bank techniques, 20: 43650
**JURET, P.,** Comparative evaluation of oophorectomy and radiation castration according to excretion of urinary gonadotropins, 20: 43044
**JURY, S. H.,** Foam decontamination of air containing radioactive iodine, 20: 43585 (ORNL-TM-1589)

K

**KABAKCHI, A. M.,** Chemical dosimetry of ionizing radiations, 20: 43293 (AD-633448)
**KABIR, P. K.,** Isospin properties of electromagnetic interactions, 20: 44371
**KACAKI, J.,** Effect of local irradiation of head of rats in infantile period on spermatogenesis, 20: 42961
**KACHKOVA, V. G.,** Metabolism of vitamins in dogs fed meat products pasteurized by $\gamma$ irradiation, 20: 42793
**KADYK, John A.,** $K_2^0p$ interactions at low momentum, 20: 44250
**KAGANOVE, J. J.,** Chemical binding effects on resonance line shapes of $^{238}U$ in $UO_2$ lattice, 20: 45064 (CONF-660303, pp 134-45)
**KAHAN, R. S.,** Versatile $^{60}Co$ irradiation facility within a swimming-pool reactor, 20: 43791
**KAHN, J. S.,** Mineralogical investigations in debris of Gnome event near Carlsbad, New Mexico, 20: 43464
**KAINDL, K.,** Pasteurization of fruit juices by irradiation, 20: 43787
**KAIPOV, D. K.,** Electrolytic cell for radioactive isotopes, 20: 43395
**KAISER, William C.,** Scintillation spectrometry: the state of the art, 20: 43096
**KAJFOSZ, Josef,** Summation spectrometer as detector of linear gamma-ray polarization, 20: 43683
**KAJZAR, Franciszek,** Second correction to the phase integral calculated by the Lurcat and Mazur method, 20: 44182
**KAKUSHKINA, M. L.,** Electric conductivity and autolysis of muscle tissues in irradiated animals, 20: 42929
**KAKUSHKINA, M. L.,** Mechanism of impairment of oxidative phosphorylation in tissues of irradiated animals, 20: 42825
**KALASHNIKOV, N. P.,** Theory of the multiple scattering in an inhomogeneous medium, 20: 44212
**KALBERER, F.,** Tritium-labeled cardiac glycosides, 20: 42722
**KALIFA, J.,** Production and study of the isomers $^{179m}Hf$ and $^{177m}Yb$, 20: 44709
**KALINKIN, B. N.,** Closed shells for $Z > 82$ and $N > 126$ in a diffuse potential well, 20: 44640 (JINR-P-2793)
**KALINKIN, B. N.,** Closed shells for $Z > 82$ and $N > 126$ in a diffuse potential well, 20: 44774
**KALINOWSKI, Bohdan,** Investigations on the obtaining of spherical uranium dicarbide particles from uranium dioxide, 20: 43876
**KALISZ, Jozef,** New design of transistor radiation detectors, 20: 43728
**KALLFELZ, F. A.,** Radioisotopes in veterinary medicine, 20: 42723
**KALLMANN, H.,** International symposium on luminescence. Physics and chemistry of scintillators, Munich, 9/65, 20: 45044
**KALLOSH, R. E.,** Connection between dispersion relations and current algebras, 20: 44223
**KALMA, A. H.,** Production of disordered regions in germanium by electron irradiation, 20: 45009
**KALMYKOV, A. A.,** Interaction between plasmoids of a magnetic field of acute-angled geometry, 20: 44975
**KALUGIN, V. N.,** Approximate computation of the variation in the electric conductivity of a gas in a vortex magnetohydrodynamic flow, 20: 44412
**KALYAZIN, E. P.,** Liquid-phase radiation-induced carboxylation of hydrocarbons with $CO_2$, 20: 43333
**KAMADA, H.,** Primary x-ray analyzer. II., 20: 43161
**KAMATH, P. R.,** Determination of radioruthenium in urine, 20: 43129
**KAMATH, P. R.,** New technique for determination of $^{14}C$ in biological materials (urine), 20: 43136
**KAMATH, S. D.,** Uranyl chloride complexes of pyrazine and substituted pyrazines, 20: 43243
**KAMIKAWA, T.,** Zero-phonon lines of color centers in LiF and NaF, 20: 45035
**KAMIYAMA, Hiroshi,** Ionization and excitation by precipitating electrons, 20: 44474
**KAMNEV, A. G.,** Device for developing fast atomic and molecular beams, 20: 44145
**KANE, G. L.,** Dynamical models and mass formulas for resonance multiplets, 20: 44370
**KANE, J. F.,** Repair and modification techniques used on large scale separation facilities, 20: 43416 (ISO-SA-24)
**KANE, Jasmine E.,** Ecosystem in the coastal waters of the Ligurian Sea. II., 20: 42734
**KANE, R. P.,** Daily variation of cosmic-ray intensity during active and quiet periods of solar activity, 20: 44161
**KANEKO, Yoshihiko,** Measurement of space-dependent source transfer

function using pulsed neutron source, 20: 45082

**KANELLAKOPULOS, B.**, Tricyclopentadienylneptunium chloride, 20: 43230

**KANKELEIT, E.**, Magnetic moment of the first excited state in $^{171}$Yb, 20: 44752

**KANTOR, Gideon**, Group propagation in the Whistler-hydromagnetic extension of magnetoionic theory, 20: 44469

**KANTROWITZ, Arthur**, Shock tube and plasma dynamics, 20: 44167

**KAPLAN, D. E.**, Observation of cyclotron echoes from a highly ionized plasma, 20: 44936

**KAPLAN, I.**, Spatial distributions of fast neutrons in lattices of slightly enriched U rods moderated by $D_2O$, 20: 45077 (MIT-2344-5)

**KAPLAN, I.**, Use of neutron absorbers for the experimental determination of lattice parameters in subcritical assemblies, 20: 45078 (MIT-2344-6)

**KARAKIDA, Yoshifumi**, Lead-alpha ages of some granitic rocks from North Kyushu and Central Japan, 20: 43556

**KARALOVA, Z. K.**, Express method for separating ionium ($^{230}$Th) from sulfuric acid uranium solutions, 20: 43147

**KARAPANDZIC, M.**, Magnetic hyperfine structure of the $^{57}$Fe impurity nucleus, 20: 45033

**KARASEK, F. J.**, Improvements in consolidation and fabrication of V-20 wt.% Ti (TV-20), 20: 43846 (ANL-7127)

**KARCZ, Waldemar**, Semiconductor system for charged particles identification, 20: 43717

**KARDASHEV, A. V.**, Research in USSR on conservation of fish and fish products by $\gamma$ irradiation, 20: 43776

**KARRAS, Hans**, Absorption, fluorescence, and bleaching of pure and activated Cd fluoride crystals, 20: 45006

**KARRER, Karl**, Leukocyte count as criterium of toxicity from combined use of radiation and cytostatic substances, 20: 42965

**KASE, Hiromi**, Unified wave equation for elementary particles, 20: 44383

**KASHIWAGI, Michio**, Electron spin resonance of irradiated single crystals of dichloroacetamide, 20: 43297

**KASHLIK, K.**, Differential cross section of $^{16}O(t,\alpha)^{15}N$ and $^{16}O(t,p)^{18}O$ reactions at energy range from 0.6 to 1.75 Mev, 20: 44641 (JINR-P-2796)

**KASTEN, Paul R.**, Design studies of 1000-Mw(e) molten-salt breeder reactors, 20: 45116 (ORNL-3996)

**KASYANENKO, A. G.**, Radiation genetics of Arabidopsis thaliana (L.) heynh. I., 20: 42900

**KATO, Hatao**, Unusual movement of daughter chromosome group in telophasic cells following irradiation, 20: 42895

**KATO, Osamu**, Group constants for a fast reactor and sodium void effects, 20: 45075 (JAERI-1109)

**KATO, Ryuhei**, Activation analysis of cancer, 20: 43138

**KATRICH, N. P.**, Sputtering of stainless steel by $H_1^+$ ions, 20: 44131

**KATSUMORI, Hiroshi**, Comment on the mass formulas derived from group theory, 20: 44378

**KATSURAGI, Satoru**, Group constants for a fast reactor and sodium void effects, 20: 45075 (JAERI-1109)

**KATZ, Lewis**, Refinement of the crystal structure of $Zn_2Mo_3O_8$, 20: 43919

**KATZENSTEIN, J.**, Light scattering by plasmas, 20: 44938

**KAUFFMAN, F. L.**, Consumer evaluations of meat products sterilized by irradiation at low temperatures, 20: 43795

**KAUFFMAN, J. W.**, Stage I recovery of pure Ag and the correspondence with Cu, 20: 44022

**KAUFFMAN, Shirley L.**, Carcinogenesis in naturally tumour-resistant mice, 20: 42873

**KAUFMAN, Joyce J.**, Theoretical treatment of hydrogen abstraction by hot tritium atoms, 20: 43408

**KAUL, B. L.**, Sensitivity of low- and high-altitude barley to gamma rays, 20: 42894

**KAULEN, D. R.**, Immunologic reactivity of radiochimeras, 20: 42878

**KAUN, K. H.**, Energy levels and rotation-particle coupling in $^{155}$Eu, 20: 44736

**KAUSHAL, N.**, Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)

**KAUTSKY, Hans**, Possible enrichments of distinct radioactive elements in river mouths, 20: 45225

**KAVANAGH, R. W.**, Decay of $^{34}$Ar, 20: 44759

**KAVANAGH, R. W.**, Energy levels of $^{37}$K, 20: 44838

**KAVANAGH, R. W.**, Reaction $^9Be(\alpha,n)^{12}C$, 20: 44723

**KAVANAGH, T. M.**, Measurement of the variation of the ratio of fission to absorption in $^{235}$U between 1 and 100 ev incident neutron energy, 20: 44648 (NRDC-117)

**KAW, Predhiman Krishan**, Nonlinear interaction of a number of electromagnetic waves in a magnetoplasma, 20: 44954

**KAWABATA, Kin-aki**, Acceleration of plasma cloud producing geomagnetic storm and origin of flare phenomena, 20: 44471

**KAWABATA, Kin-aki**, X-ray sources of solar flares, 20: 44101

**KAWASAKI, Satoru**, Swelling of metallic uranium, 20: 43995 (JAERI-4037)

**KAWASAKI, Sunao**, Echelle monochromator and application to ion temperature measurement, 20: 44920

**KAY, Eric**, Method for studying sputtered particles by emission spectroscopy, 20: 43660

**KAZAKEVICH, A. T.**, Application of autoradiography for control of irregularity of actinide element layers, 20: 43866

**KAZAKOVA, T. A.**, Cesium-137 content in human bone, 20: 42741 (NP-16265)

**KAZANAS, Nuria**, Identification of bacteria isolated from irradiated and nonirradiated yellow perch fillets, 20: 43793

**KAZARINOV, Yu. M.**, Phase-shift analysis of nucleon-nucleon scattering at 400 Mev, 20: 44191

**KAZARINOVA, M. I.**, Fast neutron spectrometer using Si surface-barrier detectors and $Li^6F$, 20: 43718

**KAZIMOTO, T.**, Level of protein intake on alteration of liver composition in irradiated rat, 20: 42864

**KAZUMATA, Y.**, Zero-phonon lines of color centers in LiF and NaF, 20: 45035

**KEARNS, W. H.**, Fabrication of a columbium alloy liquid metal loop, 20: 43879

**KECK, Chr.**, Problems of modern particle accelerators. I., 20: 44053

**KECKI, Zbigniew**, Primary processes in radiation chemistry as studied by mass spectrometry. VII., 20: 43335

**KEEN, N. J.**, Recovery of uranium from Zircaloy–uranium alloy, 20: 43438

**KEENAN, Robert G.**, Analytic determination of Be, 20: 43108

**KEHOE, B.**, Experimental test of time-reversal invariance in $\Sigma^0 \to \Lambda^0 + e^+ + e^-$, 20: 44251

**KEHOE, R. B.**, Plutonium: reserved for fast reactors, 20: 43875

**KEILIN, V. E.**, Investigation of high-current-carrying leads into liquid helium, 20: 44509

**KEISER, G.**, Hematopoietic stem cell function of lymphoid cells of blood, 20: 42784

**KEITH, J. E.**, Research activities of the A.E.C. aircraft in atmospheric testing, 20: 44417 (LA-DC-7837)

**KELLER, E. L.**, Radiation-induced peak effect in superconducting Nb–Zr, 20: 44505

**KELLER, W. E.**, Dissipation and critical velocities in superfluid helium, 20: 44503 (LA-DC-8165)

**KELLERMANN, O.**, Selection and safety evaluation of reactor sites, 20: 45054

**KELLEY, G. G.**, Present status and objectives of DCX-2 experiment, 20: 44856 (ORNL-4011)

**KELLEY, T. G.**, General comment concerning the J dependence of direct reaction cross sections, 20: 44773

**KELLY, B. T.**, Effect of fast neutron irradiation on $C_{33}$ elastic modulus of graphite, 20: 44018

**KELLY, B. T.**, Mechanism of dimensional changes in crystals of graphites and carbons under fast-neutron irradiation, 20: 44020

**KELSH, R. D.**, Containment methods for alpha-gamma radioactivity at Savannah River Laboratory caves, 20: 43466 (DP-MS-66-16)

**KENDALL, K.**, Influence of AET and hypoxia on recovery from radiation injury, 20: 42988

**KENMOKU, A.**, Level of protein intake on alteration of liver composition in irradiated rat, 20: 42864

**KENNEDY, D. I.**, Influence of charge effects on the electrical conductivity of thin metal films, 20: 44510

**KENNEDY, James**, Bibliography on physical properties and phase diagrams of ten refractory oxides, 20: 43911 (UCRL-6262(Pt.1))

**KENNEDY, W. T.**, Source of error in plasma electron oscillation measurements, 20: 44940

**KENNETT, T. J.**, Level structure of $^{104}$Rh observed in thermal neutron capture, 20: 44690

**KENNETT, T. J.**, Reaction $^{59}Co(n,\gamma)^{60}Co$, 20: 44729

**KERESELIDZE, A. B.**, Bremsstrahlung of charged particles in a Coulomb field, 20: 44039

**KERLIN, E. E.**, Prog. rpt. on effects of various combination of nuclear radiation, vacuum, and cryotemperatures on engineering materials, 5/64–5/66, 20: 43994 (FZK-290)

**KERN, J.**, Decay of $^{192}$Ir, 20: 44700

**KERRIGAN, Felix J.**, Neutron activation analysis utilizing simplex method of linear programing, 20: 43159

**KERSHNER, Larry**, Solvent isotope effects in amide hydrolysis, 20: 43280

**KESHISHIAN, Vahe**, Need for $^{238}$Pu and $^{244}$Cm cross section data, 20: 44628 (CONF-660303, pp 964-70)

**KESKI, James R.**, Prog. rpt. on recrystallization and sintering of oxides, 9/65–8/66, 20: 43813 (COO-1122-3)

**KESSLER, Paul**, New method for Feynman diagram calculation, 20: 44294

**KESTELOOT, A. V.**, Closed-circuit television in nuclear industry, 20: 43472

**KESTIGIAN, M.**, Optical phenomenon in $LiNbO_3$ single crystals, 20: 43950

**KETZLACH, N.**, Nuclear safety in plutonium metallurgy, 20: 43578 (HW-59541)

**KEVAN, Larry**, Argon sensitized radiolysis of liquid propane, 20: 43368

**KEVAN, Larry**, Paramagnetic relaxation characteristics of trapped electrons and H atoms in irradiated frozen solutions, 20: 43290 (COO-1528-7)

**KEVROLEV, V. P.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)

**KHAN, A. A.,** Development of U-Foam air filters, 20: 43570 (AEET-244)

**KHAN, A. A.,** Incineration of low-level radioactive solid wastes and gas cleaning, 20: 45214 (AEET-243)

**KHARBANDA, J. L.,** Separation and estimation of $^{228}$Ra in Th plant effluent, 20: 43442

**KHARE, Mohan,** Kinetics of annealing of $\gamma$-irradiation damage in potassium bromate, 20: 43362

**KHIZHNYAK, N. A.,** Injection of particles into a mirror trap through magnetic cusp configuration, 20: 44971

**KHOI, Le Dong,** Nuclear magnetic resonance in nickel particles with a single domain, 20: 45000

**KHOMUTOV, A. I.,** Radiation-chemical synthesis of new mineral-organic ion-exchange materials, 20: 43311

**KHOPKAR, P. K.,** Selectivity coefficients of monovalent cations for dinoylnaphthalene sulfonate, 20: 43447

**KHOVANOVICH, A. I.,** Glass-base dosimeters with optical density changes induced by radiation, 20: 43679

**KHOVANOVICH, A. I.,** Ionization chamber for measuring thermal neutron fluxes, 20: 43680

**KHUSSAR, Yu. P.,** Restoration of chicken thymus lymphoid tissue following irradiation, 20: 42935

**KIENLE, P.,** Magnetic properties of the $K = ½$ rotational band of $^{171}$Yb, 20: 44753

**KIENZLE, W.,** Structure within the R(1675) boson and possible structure within the $A_2$(1290), 20: 44245

**KIKUCHI, Yozo,** Behavior of kidney-, liver-, and serum esterase of rats following irradiation, 20: 42824

**KILIAN, P.,** Contribution of industry to the fast breeder project with steam cooling, 20: 45150

**KILLEBREW, Rosamond,** Effects of $^{60}$Co radiation on the melanophores of Gambusia affinis and Mollienisia latipinna, 20: 42905

**KILLEBREW, Rosamond,** Effects of $^{60}$Co irradiation of Euglena gracilis ($K_1$), 20: 42906

**KIM, G. G.,** Distribution of radioisotope $^{40}$K and internal irradiation dose in organs and tissues in humans and sheep, 20: 42940

**KIM, V. Kh.,** Influence of radiation on development in mice of cancer of skin induced by DMBA, 20: 42969

**KIM, Y. B.,** Effect of structure on the superconducting properties of eutectic alloys, 20: 44514

**KIMOTO, S.,** Primary x-ray analyzer. II., 20: 43161

**KIMURA, Hirokazu,** Plasma ion gun with Pierce electrode, 20: 44922

**KING, C. A. Jr.,** Electron-spin-resonance in fast-neutron-irradiated phosphorus-doped silicon, 20: 43986

**KING, C. R.,** Fluidized bed recovery of F in manufacture of $UF_6$, 20: 43199

**KING, G. A. M.,** Ionospheric disturbance and atmospheric waves. I., 20: 44437

**KING, Gerald A.,** Radiosensitivity of vestibular apparatus of rabbit, 20: 42858 (UCRL-16246, pp 74-83)

**KINGSLEY, R. S.,** Multi-column ion exchange purification-concentration process for Am, 20: 43183 (RL-SEP-729(Rev.))

**KINGSTON, F. G.,** $T = 2$ isobaric multiplet at mass 24, 20: 44758

**KINOSHITA, Yukiko,** Electromagnetic structure of the nucleon with many-particle structure, 20: 44269

**KIRBY, L. J.,** Ion-exchange separation of kilocurie quantities of high purity Pm, 20: 43411 (BNWL-SA-677)

**KIRCHER, John F.,** Chemical-equilibrium studies of organic-iodide formation under reactor-accident conditions, 20: 43166 (BMI-1781)

**KIRCHMANN, R.,** Contamination of biosphere by artificial radioelements, 20: 43596

**KIRCHNER, R. A.,** Plutonium particle size study in production areas at Rocky Flats, 20: 43595

**KIRILLOV, A. I.,** Fluorimetric determination of Y in rare earth elements after separation by paper chromatography, 20: 43150

**KIRITANI, Reiko,** Oxygen exchange reaction of phenol in acidic media, 20: 43276

**KIRIYA, V. S.,** Bremsstrahlung of charged particles in a Coulomb field, 20: 44039

**KIRKBRIDE, L. D.,** Liquid plutonium fuels, 20: 43814 (LA-DC-7581)

**KIRKBY, P.,** Faraday-cup measurement of proton total reaction cross sections at 100 Mev, 20: 44687

**KIRNER, K.,** Contribution on the plasma technology of tungsten, 20: 43873

**KIROUAC, G. J.,** Polyethylene double differential inelastic scattering cross sections for epithermal neutrons, 20: 44576 (CONF-660303, pp 122-33)

**KIRSCH, L. E.,** Experimental test of time-reversal invariance in $\Sigma^0 \to \Lambda^0 + e^+ + e^-$, 20: 44251

**KIRSCHLER, L. H.,** Design properties of one heat of 2¼ Cr–1 Mo steel and 316 stainless steel in high temperature air, He and Na environments, 20: 43897 (MSAR-66-174)

**KIRZ, J.,** Comparison of quark model predictions with experiment for $\bar{p}$ p annihilation, 20: 44224

**KIRZHNITS, D. A.,** Instability of Fermi systems and specific heat of liquid $^3$He, 20: 44516

**KISDI, David,** Statistical model of the nucleus, 20: 44698

**KISELEVSKII, L.I.,** Investigation of the interaction of supersonic torches in pulse discharge, 20: 44962

**KISH, James A.,** Neutron flux albedo for concrete, 20: 44988 (NASA-TM-X-1287)

**KISHITANI, Mikio,** Activation analysis of cancer, 20: 43138

**KITTLER, H.,** Scattering of electrons on residual gas, 20: 44114

**KIVY-ROSENBERG, Evelyn,** Microcirculatory effect of serotonin on hemostasis following x-irradiation, 20: 42978

**KJEKSHUS, Arne,** Crystal structures of $Mo_2As_3$ and $W_2As_3$, 20: 43187

**KLEBER, W.,** Tungsten oxide ($WO_3$): its growth and crystallographic investigations, 20: 43257

**KLEIBEL, Franz,** Origin and treatment of radiogenic diarrhea, 20: 42994

**KLEIN, A.,** Quadrupole moment of the first excited state of spherical nuclei, 20: 44812

**KLEIN, M. J.,** Slip and fracture in single crystals of thoria, 20: 43943

**KLEIN, Peter D.,** Separation and performance capabilities of liquid scintillation counters used in dual isotope studies, 20: 43098

**KLEIN, Rudolf,** Critical magnetic field of thin superposed films, 20: 44543

**KLEINSCHMIDT, Albrecht K.,** Single-strand breaks in duplex DNA of coliphage T7, 20: 42715 (UCRL-16246, pp 145-55)

**KLEMPARSKAYA, N. N.,** Autoflora as an indicator of radiative injury of an organism, 20: 43052

**KLIMENKO, E. Yu.,** Investigation of high-current-carrying leads into liquid helium, 20: 44509

**KLIMOV, V. V.,** Electronic counters using tunnel diodes and transistors, 20: 43654

**KLIMOVSKAYA, L. D.,** Acetylcholine metabolism in sympathetic ganglion of irradiated rabbits, 20: 42875

**KLOPP, D. A.,** Comprehensive computer library of neutron activation cross sections, 20: 44608 (CONF-660303, pp 309-14)

**KLOPP, D. A.,** Cross section calculations throughout the periodic table, 20: 44609 (CONF-660303, pp 315-27)

**KLUG, Herbert,** Effects of ionizing radiation on ultramicroscopic structure of photoreceptors, 20: 42958

**KNAPP, W. G.,** Theoretical and experimental physics studies of tungsten based nuclear rockets, 20: 45199

**KNIGHT, Conrad M.,** Retention, distribution and absorption of inhaled particles, 20: 42797

**KNIGHTON, James B.,** Thermodynamics of dilute solutions of plutonium in liquid magnesium, 20: 43819

**KNOLL, G. F.,** Calculated gamma ray response characteristics of semiconductor detectors, 20: 43701

**KNOSPE, William H.,** Regeneration of locally irradiated bone marrow. I., 20: 42871

**KNUDSEN, P.,** Compatibility of SAP 930 with $UO_2$ and UC, 20: 43835 (RISO-91)

**KNUDSEN, W. C.,** Retarding potential analyzers for measuring ionospheric quantities, 20: 44457

**KNUEFER, H.,** Complete installation of the AVR Reactor, 20: 45133

**KOBAYASHI, Tsunehiro,** Electromagnetic structure of the nucleon with many-particle structure, 20: 44269

**KOBORI, T.,** KINAK: A code for one-dimensional, nuclear, thermal, and hydraulic calculation for BWR, 20: 45074 (JAERI-1107)

**KOBORI, Tetsuo,** JP-Hydro: code for study of thermal-hydro dynamics in natural-circulation, BWR, 20: 43479 (JAERI-1108)

**KOBZEV, A. P.,** Differential cross section of $^{16}O(t,\alpha)^{15}N$ and $^{16}O(t,p)^{18}O$ reactions at energy range from 0.6 to 1.75 Mev, 20: 44641 (JINR-P-2796)

**KOECHLER, C.,** Device for x-ray intensity measurements on samples undergoing irradiation, 20: 43646

**KOEHLER, H. S.,** Nucleon separation energy by K-matrix theory, 20: 44727

**KOENE, J. W.,** Associated particle method for the $D(d,n)^3He$ reaction, 20: 44813

**KOETITZ, Guenther,** Absorption, fluorescence, and bleaching of pure and activated Cd fluoride crystals, 20: 45006

**KOFLER, Emilio,** Presumptive radioprotective action of lysozyme, 20: 42993

**KOFLER, Emilio,** Serum lysozyme in animals subjected to whole-body x irradiation, 20: 42944

**KOH, C. J.,** Intrinsic mass-splitting in a de Sitter world, 20: 44338

**KOHMAN, Truman P.,** Prog. rpt. on nuclear chemistry and geochemistry, annual, 1965–66, 20: 43550 (NYO-844-67)

**KOHMURA, Toshitake,** Canonical ensemble formalism for multiple production, 20: 44373

**KOIKE, S.,** Anomalous attenuation of ultrasonic waves in superconducting niobium, 20: 44529

**KOIKE, S.,** Peak effect in the magnetization of superconducting niobium, 20: 44528

**KOKES, R. J.,** Hydrogen–deuterium equilibration over Pd hydride, 20: 43232

**KOKKEDEE, J. J. J.,** Possible vanishing of strong interaction cross-section at infinite energies, 20: 44206
**KOKORIN, V. V.,** Incipient decomposition stages of supersaturated Co–Ta and Co–Nb solid solutions, 20: 43938
**KOLAR, Jaromir,** Metabolism in epi- and metaphysis after local x irradiation. VIII., 20: 42785
**KOLESNIKOV, A. G.,** Contamination of Atlantic Ocean by long-lived radionuclides 1963–1964, 20: 43540
**KOLESNIKOV, A. G.,** Determination of the rate of radioactive contamination of the Black Sea, 20: 43539
**KOLESNIKOV, Iu. A.,** Dynamics of a non-cylindrical Z-pinch plasma sheath at a stage prior to cumulation, 20: 44872 (LA-tr-66-58)
**KOLLATH, R.,** Comment on the multiple emission of secondary electrons, 20: 44112 (ORNL-tr-1266)
**KOLOMYTSEV, P. T.,** Phase composition and properties of alloys Mo–Ni–B system, 20: 49573
**KOMAR, A. P.,** Coherent bremsstrahlung radiation of 15-Mev electrons in a silicon monocrystal, 20: 45020
**KOMAROV, V. V.,** Differential crossing of inelastic interaction of nucleon with deuteron, 20: 44275
**KOMYAK, A. I.,** Infrared absorption spectrum of monocrystals of sodium uranyl acetate, 20: 43285
**KONDO, Keniro,** Chemical effects associated with (n,γ) and (n,2) reactions in benzene solutions of ethylbromide and bromobenzene, 20: 43334
**KONDO, M.,** Comparative metabolism of Cs and K in mammals, 20: 42768
**KONENENKO, V. I.,** Determination of the spatial density distribution of a plasma using microwave refraction, 20: 44982
**KONENKO, O. R.,** Charged particle concentration waves in a moving plasma, 20: 44958
**KONNOVA, N. I.,** Radiobiological effects in animals after preliminary action of acceleration, 20: 42985
**KONO, Toshihiko,** Activation analysis of cancer, 20: 43138
**KONONENKO, V. I.,** Bremsstrahlung of a $\theta$-pinch plasma in the infrared spectral region, 20: 44984
**KONONENKO, V. I.,** Studying a plasma by probing with microwaves, 20: 44983
**KONOPLEVA, N. P.,** Coordinate transformation and compensating fields, 20: 44390
**KONOTOP, V. V.,** Condenser batteries with 625-kJ stored energy for producing strong magnetic fields, 20: 43457
**KONOTOP, V. V.,** Performance of 625-kJ battery using physical model, 20: 43458
**KONOVALOV, V. G.,** Preliminary photoionization of helium in a gas discharge shock tube, 20: 44980
**KONSTANTINOVA-SCHLESINGER, M. A.,** Determination of U by measuring width of the luminescence zone on chromatogram, 20: 43151
**KONUMA, M.,** Current commutation relations and meson photoproduction near threshold, 20: 44211
**KOOB, R. D.,** Argon sensitized radiolysis of liquid propane, 20: 43368
**KOONTZ, W. H.,** Repair and modification techniques used on large scale separation facilities, 20: 43416 (ISO-SA-24)
**KOPECKY, V.,** Quasilinear theory of two-stream cyclotron instability of electron beams, 20: 44894
**KOPP, P. M.,** Effect of alpha and gamma radiation on an enzyme, 20: 42816
**KOPPENAAL, T. J.,** Strengthening mechanism in neutron-irradiated Cu single crystals, 20: 45030
**KORIDALIN, V. E.,** Wide-range detector of light pulses, 20: 43722
**KORITSANSZKY, Denes,** Preparation of $^{131}$I-labeled hippuran, 20: 43388
**KORNBERG, H. A.,** Radionuclides in Alaskan Eskimos, 20: 43622
**KORNILOV, A. N.,** Standard heat of formation of Nb carbides in NbC phase, 20: 43261
**KORNILOV, E. A.,** Spatial and temporal correlations of electric fields in a weakly turbulent plasma, 20: 44924
**KOROBKIN, V. V.,** Stabilized power supply for electron-optical converters, 20: 43656
**KOROBOCHKO, Yu. S.,** Coherent bremsstrahlung radiation of 15-Mev electrons in a silicon monocrystal, 20: 45020
**KOROTKOV, L. I.,** Handbook of automatic control instruments with isotope sources, 20: 43639 (AEC-tr-6633)
**KOROTKOVA, A. P.,** Effect of $^{137}$Cs γ-rays on seeds of winter wheat, 20: 42897
**KOROVINA, L. I.,** Theory of $\beta$-decay in the external magnetic field, 20: 44274
**KOSAKA, Atsuo,** JP-Hydro: code for study of thermal-hydro dynamics in natural-circulation, BWR, 20: 43479 (JAERI-1108)
**KOSHEL, R. D.,** Use of Green functions in nuclear theory, 20: 44836
**KOSKI, Walter S.,** Theoretical treatment of hydrogen abstraction by hot tritium atoms, 20: 43408
**KOSLEROVA, J.,** Formation of scandium oxide chloride phases, 20: 43260
**KOSS, P.,** Fabrication methods and evaluation of U–Th–C fuel, 20: 43860 (SGAE-CH-35/1966)
**KOSTOMAROV, D. P.,** Plasma density spatial distribution measurements by means of multi-beam microwave probing, 20: 44857 (IAE-1153)
**KOSTYU, Ya. E.,** Determination of oil–water interface based on delayed neutron detection, 20: 43553
**KOSYAKOV, V. I.,** Automatic magnetic field calibrator for EPR microwave spectrometers, 20: 43720
**KOTULA, Edward,** Possibility of reduction of chemicals consumption in U ore leaching process, 20: 43441
**KOUTZ, Stanley L.,** Peach Bottom Atomic Power Station, 20: 45170
**KOVALIN, Ya. V.,** Electronic counters using tunnel diodes and transistors, 20: 43654
**KOVPIK, O. F.,** Spatial and temporal correlations of electric fields in a weakly turbulent plasma, 20: 44924
**KOVTUN, R. I.,** Charge drift in spatially periodic, 20: 44973
**KOVTUN, R. I.,** Exact resonance during charge drift in slowly varying spatially modulated magnetic field, 20: 44974
**KOVTUN, R. I.,** Microwave refraction by a nonhomogeneous cylindrical plasma, 20: 44981
**KOVTUN, R. I.,** Studying a plasma by probing with microwaves, 20: 44983
**KOYAMA, K.,** Neutron-induced changes in crystallinity and thermal conductivity of pyrolytic carbons, 20: 44009
**KOYAMA, K.,** Structure and properties of pyrolytic carbons prepared in a fluidized bed between 1900 and 2400°C, 20: 43930
**KOZIK, B.,** Correlation of neutrons in nuclear reactors, 20: 45053
**KOZLOV, F. A.,** Leakage discovery in Na–$H_2O$ steam generator, 20: 45059
**KOZLOV, S. I.,** Evaluation of the coefficient of dissociative recombination in the lower ionosphere, 20: 44464
**KOZLOV, V. A.,** Biological effect of space-flight factors using lysogenic bacteria, 20: 42911
**KOZLOV, V. A.,** Biological studies carried out in satellites, 20: 42912
**KOZLOV, V. A.,** Problem of using radioprotective pharmacological agents under spaceflight conditions, 20: 43004
**KRAFT, R. W.,** Effect of structure on the superconducting properties of eutectic alloys, 20: 44514
**KRAMER, G.,** Application of spectral representations to the nonrelativistic and the relativistic Bethe-Salpeter equation, 20: 44298
**KRAMER, W. C.,** Improvements in consolidation and fabrication of V-20 wt.% Ti (TV-20), 20: 43846 (ANL-7127)
**KRAMMER, Margarete,** $SU_6$ Clebsch-Gordan coefficient for the product $35 \otimes 35$, 20: 44285
**KRASOVITSKII, V. B.,** Theory of amplification of longitudinal waves by a charged particle beam in a nonlinear plasma, 20: 44965
**KRAUCH, Carl Heinrich,** Electron and γ-ray induced addition of formamide to olefins, 20: 43347
**KRAUS, W.,** Occupational radiation exposures in the German Democratic Republic in 1964, 20: 43614
**KREBS, Jean-Pierre,** Neutron diffraction study of $U_2C_3$, 20: 45002
**KREGAR, M.,** Analysis of the low lying $0^+$ states in the middle weight nuclei, 20: 44647 (NIJS-R-484)
**KREHBIEL, H.,** Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 $F^{-2}$, 20: 44253
**KREJCI, L. E.,** Chemistry of Be, 20: 43107
**KREUZER, W.,** Contamination of poultry meat and egg products with $^{137}$Cs, 20: 42735
**KRIEGER, S. J.,** Hartree-Fock calculations with a density-dependent interaction, 20: 44785
**KRIMIGIS, S. M.,** Protons in magnetosphere, 20: 44455
**KRIPYAKEVICH, Petro I.,** Crystal structure of the compound $TbAl_3$, 20: 43926
**KRISHNAMURTHY, B. V.,** Topside and bottomside spread F, 20: 44446
**KRISYUK, I. T.,** Computation of partial and complete yields of fission fragments, 20: 44819
**KROLL, N. M.,** Ad hoc modifications of quantum electrodynamics, 20: 44488
**KRUPCHATNIKOV, V. M.,** Ventilation in work with radioactive substances, 20: 43593 (AEC-tr-6642)
**KRZYWDZINSKI, S.,** Central collisions of nucleons with heavy nuclei for energy higher than $10^{12}$ ev, 20: 44286
**KUBOSE, D. A.,** Radioactivity release from radionuclide power sources. II., 20: 43592 (USNRDL-TR-1042)
**KUCHLY, J. M.,** Charge collection time of lithium-compensated silicon radiation detectors, 20: 43703
**KUDO, Kiyoshi,** Determination of trace amounts of Cu using the quantitative isotope dilution method, 20: 43137
**KUDO, Shoko,** Anisotropy of cosmic rays parallel to rotation axis of the earth, 20: 44475
**KUDRYASHOV, Yu. B.,** Mechanism of impairment of oxidative phosphorylation in tissues of irradiated animals, 20: 42825
**KUEHNE, B. M.,** Surface effects of radiation on microelectronic devices. II., 20: 43752 (AD-635583)
**KUESER, P. E.,** Prog. rpt. on magnetic and electrical materials capable of

operating in 800 to 1600°F temperature range, 6–8/65, 20: 43815 (NASA-CR-54356)
**KUGE, Y.,** KINAK: A code for one-dimensional, nuclear, thermal, and hydraulic calculation for BWR, 20: 45074 (JAERI-1107)
**KUGE, Yasushi,** JP-Hydro: code for study of thermal-hydro dynamics in natural-circulation, BWR, 20: 43479 (JAERI-1108)
**KUGLER, E.,** Breakdown of an electrodeless ring discharge and the development of the electron density and temperature in a spindle cusp, 20: 44860 (JUL-352-PP)
**KUKARIN, A. I.,** Ionization chamber for measuring thermal neutron fluxes, 20: 43680
**KUKIN, I. K.,** Two-dimensional isothermal flow of conducting liquid and gas in channel with electric and magnetic fields, 20: 43490
**KULIK, I. O.,** Nuclear magnetic resonance in the resistive state of superconductors of the second kind, 20: 44517
**KUMAR, M. Ashwini,** Measurement of $^{45}$Ca in serum by liquid scintillation, 20: 43117
**KUMASAKA, Nobuyuki,** Superconducting transition temperatures of lead alloys, 20: 44515
**KUMMER, W.,** Pion decays in the static quark model, 20: 44200
**KUMOK, V. N.,** Ion hydrolysis of rare earths and Y in aqueous solutions, 20: 43221
$^{3}$H and $^{3}$He, 20: 44692
**KUNZ, P. D.,** Complete variational wave function for the ground state of
**KUO, Wu-ming,** Radiation for automatically controlling level of liquid metal in crystallizer when steel is cast, 20: 43761
**KUPER, C. G.,** Little's proposal for a superconducting organic polymer, 20: 44541
**KUPPERMANN, Aron,** Prog. rpt. on chemical dynamics and radiation chemistry, annual, 7/65–6/66, 20: 43288 (CALT-532-1)
**KUPSCH, J.,** Photoproduction processes in the quark model, 20: 44239
**KURILKO, V. I.,** Theory of amplification of longitudinal waves by a charged particle beam in a nonlinear plasma, 20: 44965
**KURODA, K.,** Measurement of the parameters D and R′ in proton-deuteron triple elastic scattering, 20: 44233
**KURODA, P. K.,** Mass yield spectrum of cosmic-ray-produced xenon, 20: 44079
**KUROKAWA, Ryosuke,** Measurement of space-dependent source transfer function using pulsed neutron source, 20: 45082
**KURUP, C. K., Ramakrishna,** Oxidative phosphorylation in fractionated bacterial systems. XXII., 20: 42810
**KUSTAANHEIMO, P.,** Route dependence of the gravitational red shift, 20: 44490
**KUTA, J.,** Polarographic study of reduction and dismutation of U in aqueous solutions of acetylacetone, 20: 43205
**KUTI, J.,** Pion decays in the static quark model, 20: 44200
**KUZMICHEV, V. N.,** Generator of a sequence of random pulses, 20: 43652
**KUZ'MIN, V. A.,** Upper limit of the spectrum of cosmic rays, 20: 44155
**KUZMINA, N. P.,** Intensity distribution in induced combinational scattering spectra, 20: 44148
**KUZ'MINOV, B. D.,** Fission fragments for fission of $^{235}$U induced by thermal neutrons and 5, 6, and 7 Mev neutrons, 20: 44673 (LA-tr-66-36)
**KUZNETSOV, G. I.,** Multidimensional Coulomb problem, 20: 44150
**KUZNETSOV, M. I.,** Low-noise $\beta$-counter, 20: 43719
**KUZNETSOV, V. G.,** Relative biological effectiveness of high-energy protons affecting cabbage seeds, 20: 42898
**KUZNETSOV, Yu. K.,** Drift instability of plasma discharge with oscillating electrons, 20: 44863 (NP-16310)
**KWASNITZA, K.,** Measurement of critical field $H_{c3}$ and critical surface current in superconducting V–Ti alloys up to 30 kOe, 20: 44535
**KWIECINSKI, J.,** Equal time commutators and scalar mesons decays, 20: 44289

L

**LABORDE, Marguerite,** Effect of whole body irradiation by x rays on thyroid metabolism of rat, 20: 43029
**LADANYI, K.,** Maximal groups and the possibility of the dynamical origin of internal symmetries, 20: 44339
**LADYGIN, A. Ya.,** Influence of neutron radiation on some properties of refractory concretes, 20: 44005
**LAFFERTY, Robert H. Jr.,** AEC food-irradiator program, 20: 43766
**LAFFERTY, Robert H. Jr.,** Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758
**LAFFERTY, Robert H. Jr.,** Selected abstracts of non-U. S. literature on production and industrial uses of radioisotopes, 20: 43757 (ORNL-TM-1505(Pt.2))
**LAI, M. G.,** Radioactivity release from radionuclide power sources. II., 20: 43592 (USNRDL-TR-1042)
**LAI, Tsai-teh,** Polarography and zone electrophoresis of uranyl-L-methionine complexes, 20: 43229
**LAJTHA, L. G.,** Radioprotection in total-body-irradiated primates, 20: 42980
**LAL, Sudarshan,** Reagents for the qualitative analysis of Ce(III)–Ce(IV)
**LALANNE, C. M.,** Comparative evaluation of oophorectomy and radiation castration according to excretion of urinary gonadotropins, 20: 43044
**LALIT, B. Y.,** Radiochemical determination of $^{90}$Sr and $^{137}$Cs in drinking water and milk in Bombay, 20: 43532
**LAMANNA, Anthony,** Radiochemical determination of U in environmental media by electrodeposition, 20: 43405
**LAMBRINO, V.,** Contributions to application of certain aluminosilicates as ion exchangers in decontamination of radioactive solutions, 20: 43449
**LAMIRAL, G.,** Prestressed concrete containments in nuclear power plants, 20: 45127 (ORNL-tr-1228)
**LAMPTON, M.,** Auroral-zone microbursts, 20: 44453
**LANCMAN, H.,** Decay scheme of $^{23}$Ne, 20: 44637 (INR-627/IA/PL)
**LAND, E. J.,** Pulse radiolysis investigations of unimolecular elimination reactions in free radicals produced by OH addition to hydroxybenzenes, 20: 43332
**LANDMAN, Donald A.,** Hyperfine structure $^{2}D_{5/2}$ and $^{4}F_{9/2}$ states of $^{107}$Ag and $^{109}$Ag, 20: 44141
**LANDSHOFF, P. V.,** Extraction of singularities from the S matrix, 20: 44319
**LANDSHOFF, P. V.,** Icecream-cone singularity in S-matrix theory, 20: 44306
**LANDSHOFF, P. V.,** Normal thresholds in subenergy variables, 20: 44305
**LANDWEHR, H.,** Loading device (AVR), 20: 45139
**LANE, Zonier,** Bibliography on physical properties and phase diagrams of ten refractory oxides, 20: 43911 (UCRL-6262(Pt.1))
**LANG, J.,** Direct determination of a short nuclear lifetime ($\approx 10^{-20}$s) by the proximity scattering method, 20: 44731
**LANGE, Felix,** Double coil pulse apparatus, 20: 44512
**LANGENBERG, D. N.,** Experimental test of the Josephson frequency-voltage relation, 20: 44540
**LANGERON, Jean-Paul,** Surface aspect presented by Zr annealed in the $\beta$ phase, 20: 43933
**LANNING, D. D.,** Use of neutron absorbers for the experimental determination of lattice parameters in subcritical assemblies, 20: 45078 (MIT-2344-6)
**LAPIDOT, M.,** Versatile $^{60}$Co irradiation facility within a swimming-pool reactor, 20: 43791
**LAPTAI, R. G.,** Effects of high pressure on the alpha $\rightleftarrows$ beta transformation in Pu, 20: 43953
**LARIKOV, L. N.,** Prospects of raising the high-temperature strength of materials on the basis of refractory metals, 20: 43969
**LARKIN, A. I.,** Boundary condition of the Josephson effect, 20: 44575
**LA ROCHE, Gilles,** Effects of simulated altitude on iodine metabolism. I., 20: 42745 (UCRL-16246, pp 126-37)
**LARSEN, I.,** Inactive pilot plant studies of a process for vitrification of highly radioactive waste at the research establishment, Risoe, 20: 45230
**LARSON, R. E.,** Decay of $^{95}$Y, 20: 44722
**LASSALLE, J. C.,** Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230
**LASSOTA, Z.,** Effect of $\gamma$-rays on acetylcholine in insects, 20: 42874
**LAUBEN, G. N.,** Initial experience with large Na fires experiments (LF-1), 20: 45047 (NAA-SR-12041)
**LAUBEREAU, P.,** Tricyclopentadienylneptunium chloride, 20: 43230
**LAUDE, Francis,** Pot vitrification of concentrated fission product solutions, 20: 45233
**LAUE, H. J.,** Irradiation behavior of tempered Ni–Cr–Fe alloy, 20: 44013
**LAUER, R. R.,** Fluorimetric determination of Y in rare earth elements after separation by paper chromatography, 20: 43150
**LAUGHLIN, A. W.,** Excess radiogenic Ar in minerals of the Amelia, Virginia pegmatites, 20: 43504 (COO-689-60, App. A-4)
**LAUGHLIN, A. William,** Argon-40 in cogenetic feldspar-mica mineral assemblages, 20: 43503 (COO-689-60, App. A-3)
**LAULICHT, I.,** Infrared absorption spectrum of $^{18}$O-labeled glycine, 20: 43283
**LAUN, Donald D.,** Self-reversal in the spectral lines of uranium, 20: 44129
**LAURITZEN, T.,** Compatibility of SAP 930 with $UO_2$ and UC, 20: 43835 (RISO-91)
**LAVAKARE, P. J.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458
**LAVRENCHIK, E. I.,** Action of radiation protection agents during fractional irradiation. III., 20: 42992
**LAVRENT'EV, O. A.,** Measuring the energy of recharged particles in an electromagnetic trap, 20: 44976
**LAVRENTOVICH, Ya. I.,** Chemical dosimetry of ionizing radiations, 20: 43293 (AD-633448)
**LAVROVSKII, K. P.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)
**LAVRUKHINA, A. K.,** Nuclear chemistry, 20: 43056 (JPRS-36943)
**LAWLEY, A.,** Direct observation of etch pits at dislocations in molybdenum, 20: 43966
**LAWLEY, A.,** Microstrain behavior of beryllium single crystals, 20: 43924

**LAWRENCE, John H.,** Classification and evolution of patterns of erythropoiesis in polycythemia vera, 20: 43015 (UCRL-16246, pp 1-18)
**LAWRENCE, John H.,** Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)
**LAWRENCE, John H.,** Prog. rpt. on biology and medicine, semiannual, 1965, 20: 42711 (UCRL-16246)
**LAZAR, N. H.,** Present status and objectives of DCX-2 experiment, 20: 44856 (ORNL-4011)
**LAZARESCU, M.,** Effects of ribonuclease and deoxyribonuclease on glutamic acid and methionine uptake in Ehrlich's ascitic carcinoma tumoural cells, 20: 42728
**LAZAREV, A. N.,** Infrared spectra of rare-earth pyrogermanates and structure of $Ge_2O_7$ anions, 20: 43218
**LAZAREV, A. N.,** Infrared spectra and structure of rare-earth phosphates and sulfates, 20: 43219
**LAZZARINI, E.,** New estimation of $^{144}$Xe half-life, 20: 44706
**LE, Du Khuong,** Behavior of radioactive zinc-chelates in mammalian organisms, 20: 42789
**LEACH, L. J.,** Clearance of uranium dioxide dust from lungs following, inhalation exposures, 20: 42767
**LEBEZ, D.,** Nitrogen metabolism in frog liver after whole-body irradiation. V., 20: 42787
**LEBKOVA, N. P.,** Effect of 5-methoxytryptamine and cystamine on myelogram and degeneration of cells in hematopoietic organs of irradiated mice, 20: 42938
**LEE, Joon Chang,** Variational method for the ground state of liquid $^4$He, 20: 44491
**LEE, K.,** Temperature variation of $^{139}$La nuclear quadrupole resonance in $LaF_3$, 20: 45026
**LEE, Keum Hwi,** Green's function method for antiferromagnetism, 20: 44029 (IS-T-99)
**LEEDY, T. F.,** Measurement of the mean energy required to create an electron-hole pair in silicon between 6 and 77°K, 20: 45028
**LEFFERT, C. B.,** Electron density maximization in a Penning gas mixture ionized by fission fragments, 20: 44933
**LEGER, Louis,** Cryogenic equipment, 20: 44501 (CEA-R-3008)
**LEHAR, F.,** Phase-shift analysis of nucleon-nucleon scattering at 400 Mev, 20: 44191
**LEHMANN, Rita,** Absorption, fluorescence, and bleaching of pure and activated Cd fluoride crystals, 20: 45006
**LEIBOWITZ, J. R.,** Ultrasonic evidence for strong coupling of electrons to transverse phonons in single-crystal indium, 20: 44553
**LEIBY, D. W.,** Data processing applications to a large, dual-purpose nuclear reactor, 20: 45191 (RL-GEN-1058)
**LEISCHNER, E.,** Average charge of stripped heavy ions, 20: 44136
**LEITNAKER, J. M.,** Thermodynamic functions of nuclear materials: UC, $UC_2$, $UO_2$, $ThO_2$, and UN, 20: 43907 (ORNL-TM-1596)
**LEITNAKER, James M.,** Thermodynamic properties of UC via the U–C–O system, 20: 43947
**LEITNER, J.,** Strong decay rates and $SU_3$, 20: 44331
**LEMBERG, A. A.,** Problems of experimental and clinical radiobiology, 20: 42796
**LEMKE, B. J.,** GRISM, code to generate multigroup constants from microscopic neutron cross section data, 20: 44584 (NAA-SR-11980 (Vol.3))
**LEMKE, Barbara J.,** Neutron cross-section evaluation by AIDA, 20: 44607 (CONF-660303, pp 270-86)
**LEMMON, Richard M.,** Formation of biologically important monomers using radiations. I., 20: 42726
**LENGEMANN, F. W.,** Dietary intake of radionuclides, 20: 43573 (CONF-765-13)
**LENGYEL, L. L.,** Internal resistance of MHD generators, 20: 44164 (IPP-3/39)
**LENZI, M.,** Polymerization of tetrafluorethylene oxide, 20: 43301
**LEONARD, Ralph B.,** Preparation and some properties of $Nd_2O_2C_2$, 20: 43214
**LEONAS, V. B.,** Device for developing fast atomic and molecular beams, 20: 44145
**LEONG, G. F.,** Recovery from radiation injury in sheep, swine, and dogs as evaluated by split-dose technique, 20: 42996
**LEONTOVICH, M. A.,** Reviews of plasma physics. II., 20: 44985
**LEPEKHIN, F. G.,** Spark chamber with acoustic spark location, 20: 43725
**LEPER, D. P.,** Octupole oscillations of even-even deformed nuclei with small nonaxiality, 20: 44825
**LEPINAT, Andre,** Method of biological and medical exploration: ionography calibrated in roentgens, 20: 43028
**LEPLAE, L.,** Dynamical rearrangement of symmetries. III., 20: 44518
**LERCHE, I.,** Relativistic gardenhose instability, 20: 44880
**LESNIAK, Leonard,** Transverse sum rule for electrons scattered inelastically with large momentum transfers from light nuclei, 20: 44636 (INP-479/PL)
**LESSARD, J. R.,** Silica gel chromatographic procedure adapted to liquid-scintillation counting of $^{14}$C-labeled organic acids, 20: 43125
mixtures, 20: 43122
**LESSARD, Jean-Claude,** Canada and nuclear power, 1966, 20: 45102 (66-CNA-320)
**LEVEN, Ronald,** Nonlinear theory of deceleration and thermalization of electron beams in passage through a plasma, 20: 44882
**LEVENSON, M.,** Cost study of processing of oxide, carbide, and metal fast-breeder-reactor fuels, 20: 43410 (ANL-7137)
**LEVEY, R. P.,** Use of fluid bed equipment in enriched U processing, 20: 43202
**LEVI, C.,** Evidence for an intermediate resonance in $^{26}$Al, 20: 44768
**LEVIN, Harry,** Radiation sterilization device with uniformly distributed beta emitters, 20: 43796
**LEVIN, I. V.,** Measurements of activity of radioactive gases by spherical ionization chamber, 20: 43106
**LEVINE, Harry,** Radiochemical determination of U in environmental media by electrodeposition, 20: 43405
**LEVRAT, B.,** Structure within the R(1675) boson and possible structure within the $A_2$(1290), 20: 44245
**LEVY, H. A.,** X-ray diffraction data on liquid water in temperature range 4 to 200°C, 20: 43180 (ORNL-3997)
**LEVY, I. S.,** Improved postirradiation stress-rupture properties of Hastelloy X-280, 22: 43887 (BNWL-231)
**LEVY, Michel,** Measurement of integral flux of fast neutrons by Geiger-Mueller counters with activable cathodes, 20: 43729
**LEVY, Paul W.,** Brief survey of radiation effects applicable to geology problems, 20: 43987 (BNL-10569)
**LEVY, S. A.,** Effect of structure on the superconducting properties of eutectic alloys, 20: 44514
**LEWIS, C. W.,** Low lying spin 1 state in $^{46}$Ti, 20: 44765
**LEWIS, F. B.,** X-radiation and alkylating agents as trigger mechanisms in autoimmune complications of malignant lymphoproliferative disease, 20: 43027
**LEWIS, Gary B.,** Distribution of $^{65}$Zn in plankton from offshore waters of Washington and Oregon, 1961–1963, 20: 43545
**LEWIS, J. E.,** Sintering studies and phase characterization in the system $Eu_2O_3$–$UO_2$, 20: 43853 (GEAP-5008)
**LEWIS, R. C.,** GRISM: code to generate multigroup constants from microscopic neutron cross section data, 20: 44584 (NAA-SR-11980(Vol.3))
**LEWIS, R. N.,** Solid state nanosecond pulser using Marx bank techniques, 20: 43650
**LEWIS, R. R. Jr.,** Role of perturbed angular correlations in symmetry tests, 20: 44806
**LEWIS, W. B.,** Comparison of $^{240}$Pu and $^{238}$U in thermal fission reactors, 20: 45103 (AECL-2590)
**LEY, Gregor J. M.,** Recent results on the $\gamma$-radiation-induced polymerization of some vinyl monomers in emulsion systems, 20: 43374
**LIAO, Shutsung,** Selective inactivation of transfer ribonucleic acid, 20: 42809
**LIBERT, J.,** Symmetry defects in polarization measurements. II., 20: 43698
**LIBERT, J.,** Symmetry defects in polarization measurements. III., 20: 43699
**LIBOFF, A. R.,** Measurement of intensity of cosmic-ray ionization at sea level, 20: 44456
**LICCIARDELLO, J. J.,** Quality and wholesomeness of radiation-pasteurized marine products, 20: 43768
**LICHT, A. L.,** Local states, 20: 44309
**LICURICI, V.,** Effects of ribonuclease and deoxyribonuclease on glutamic acid and methionine uptake in Ehrlich's ascitic carcinoma tumoural cells, 20: 42728
**LIDEN, Kurt,** Increasing $^{137}$Cs level in Lapps and other people in northern Sweden, 20: 42736
**LIDIARD, A. B.,** Growth of interstitial clusters in graphite under irradiation, 20: 44021
**LIE, T. J.,** Thermodynamic properties of an electron plasma, 20: 44955
**LIEBENBERG, D. H.,** Research activities of the A.E.C. aircraft in atmospheric testing, 20: 44417 (LA-DC-7837)
**LIEBMANN, B.,** Fuel development for a high-temperature fast reactor, 20: 45100
**LIEBSCHUTZ, A. M.,** Prog. rpt. on radiation effects on microelectronic circuits, 2–4/66, 20: 43753 (AD-636773)
**LIGHTFORD, George Robert,** Improvements in or relating to mechanical handling equipment, 20: 43474
**LIIKALA, R. C.,** Sensitivity of thermal reactor parameters to scattering model, 20: 45065 (CONF-660303, pp 146-50)
**LIKINA, I. V.,** Detection of C- and $C_x$-reactive protein in irradiated blood serum, 20: 42876
**LILLEGRAVEN, A. L.,** Uptake and retention of radioactive Sr in normal subjects, 20: 42762
**LILLEY, A. E.,** Radio astronomical detection of helium, 20: 44081
**LIM, Y. K.,** Charge determination by thin-down track width measurements, 20: 43706
**LINDBERG, M.,** Neutron spectrum in a $UO_2$ tube at different temperatures,

20: 45089

**LINDGREN, Frank T.,** Particle-size distribution of low-density plasma lipoproteins, 20: 42717 (UCRL-16246, pp 176-85)

**LINDGREN, Frank T.,** Ultracentrifuge rotor temperature and speed measurement by radio telemetry, 20: 43637 (UCRL-16246, pp 168-75)

**LINDGREN, Stig,** Directional response of cosmic ray telescopes, 20: 43678

**LINDGREN, Stig,** Solar cycle variation in the attenuation length of the cosmic ray nucleon component, 20: 44425

**LINDSAY, J. D. G.,** Sensitive detection of superconductivity by changes in inductance and losses of a resonant bridge, 20: 44508

**LINETSKII, V. Ya.,** Condenser batteries with 625-kJ stored energy for producing strong magnetic fields, 20: 43457

**LINEV, S. V.,** Penetration of $^{235}$U fission fragments through $H_2$, $D_2$, He, $N_2$, Ar, Kr, and Xe, 20: 44685

**LINFOOT, John A.,** Whole-body counting of $^{47}$Ca and $^{35}$Sr, 20: 42744 (UCRL-16246, pp 19-35)

**LINIECKI, Julian,** Chronic accumulation of $^{90}$Sr in human body as predicted from retention of single dose of tracer, 20: 43619

**LINK, W. T.,** Faraday-cup measurement of proton total reaction cross sections at 100 Mev, 20: 44687

**LIPATOV, L. N.,** Double logarithmic asymptotics of quantum electrodynamics, 20: 44361

**LIPPERT, W.,** Ionospheric absorption of short waves during solar eclipse February 15, 1961. V., 20: 44427

**LIPTAK, Ya.,** Investigation of the decay scheme of $^{138*}$Pr, 20: 44643 (JINR-P-2819)

**LIPTON, Allan,** Formation of circular DNA after lysogenic induction, 20: 42721

**LITTMAN, Howard,** Prog. rpt. on gas-particle heat transfer coefficients in packed and fluidized beds, annual, 1966, 20: 43483 (RPI-3639-1)

**LITVIN, D. F.,** Apparatus for neutron diffractometry of specimens under high hydrostatic pressure, 20: 43473

**LIU, Yao-yang,** Individual-particle approximation of higher-excited states, 20: 44220

**LIVINGSTON, Donald E.,** Argon-40 in cogenetic feldspar-mica mineral assemblages, 20: 43503 (COO-689-60, App. A-3)

**LIVINGSTON, Donald E.,** Cenozoic argon ages on metamorphic rocks from the Basin and Range Province, 20: 43501 (COO-689-60, App. A-1)

**LI VOTI, P. Jr.,** Evaluating absorbed dose in gastrointestinal tract and liver from treatment with radioisotopes, 20: 43043

**LLOYD, R. M.,** Oxygen isotope enrichment of sea water by evaporation, 20: 43509

**LLOYD, Ray D.,** Strontium-90 and $^{89}$Sr dose estimates for the fetus and infant, 20: 43605

**LOBB, R. C.,** Density changes upon heat-treating unirradiated "pure" and "adjusted" U, 20: 43958

**LOBOV, S. I.,** Radioactive source of soft x radiation for physical investigations, technology, and medicine, 20: 43384

**LOCHER, M. P.,** Absorptive corrections to reaction $\gamma p \to N^{*}\pi$ in one-pion exchange model, 20: 44278

**LOCHER, M. P.,** Reggeized vector meson exchange for neutral pion-photoproduction, 20: 44240

**LOCKER, Robert J.,** Radiation detection which employs semiconductor avalanche amplification and tunnel diode element, 20: 43677

**LODER, R. K.,** Model for describing particle production by inelastic electron-nucleon scattering, 20: 44180

**LOEHR, Eberhard,** Early reactions of peripheral blood and bone marrow to lethal irradiation, 20: 42822

**LOEHR, Eberhard,** Early reactions of peripheral blood and the bone marrow after lethal irradiation. I., 20: 42955

**LOEHR, Eberhard,** Reactions of peripheral blood and bone marrow following lethal whole-body irradiation, 20: 42788

**LOENSJOE, O.,** Vibrational states of $^{152}$Sm and $^{154}$Gd populated by the $(\alpha,2n)$ reaction, 20: 44735

**LOESS, R. E.,** Crevice-galvanic corrosion of aluminum, 20: 43824 (ANL-6236)

**LOESSNER, V.,** Tables of maximum energies of characteristic beta-decay, 20: 44655 (SZS-4/66)

**LOEW, Kerstin,** Nuclear debris in upper atmosphere, 20: 43524

**LOEWENSTEIN, W. B.,** Theoretical and experimental physics studies of tungsten based nuclear rockets, 20: 45199

**LOGAN, D.,** Physical properties of steam and water above 1000 psia, 20: 43173 (NAA-SR-Memo-12006)

**LOHMANN, Adolf W.,** Particle accelerator utilizing coherent light, 20: 44067

**LOISELEUR, Jean,** Hyperproduction of diphtheria and tetanus antibodies following irradiation, 20: 42887

**LOMENICK, T. F.,** Model and underground studies of the influence of stress, temperature, and radiation on flow and stability in rock salt mines, 20: 45217 (ORNL-P-2126)

**LOMMATZSCH, Peter,** Effects of ionizing radiation on ultramicroscopic structure of photoreceptors, 20: 42958

**LONG, Michael J.,** Data handling and control circuit for liquid scintillation spectrometers, 20: 43749

**LONG, Michael J.,** Liquid scintillation spectrometer detection chamber, 20: 43748

**LONGAIR, M. S.,** Evidence on the evolutionary character of the universe derived from recent redshift measurements, 20: 44092

**LONGHI, G.,** $SU(6)_W$ algebra at infinite momentum, its tensor charges, and electric dipoles, 20: 44358

**LOOBY, Thomas,** Radioprotective action of iproniazid, 20: 42991

**LOOPSTRA, B. O.,** Neutron powder diffractometry using a wavelength of 2.6 A, 20: 45013

**LOPATA, C.,** Properties of partial radiation widths in $^{196}$Pt, 20: 44807

**LOPATIN, S. A.,** Basic features of the global $^{90}$Sr distribution on surface of world's oceans (1960–1961), 20: 43516 (AEC-tr-6798, Paper 1)

**LOPATO, P.,** Spectroscopy of $^{208}$Pb by inelastic scattering of protons at 24.55 Mev, 20: 44772

**LOPATO, P.,** Spectroscopy of $^{207}$Pb by inelastic scattering of 24.5-Mev protons, 20: 44801

**LOPES, J. S.,** Comparison of signs of mixing ratios to model predictions, 20: 44784

**LOPES, J. S.,** The $^3/_2^- \to ^1/_2^-$ mirror transitions in mass 15, 20: 44783

**LOPEZ, W. M.,** Neutron capture cross section of the W isotopes from 0.01 to 10 ev, 20: 44605 (CONF-660303, pp 182-203)

**LOPEZ APARICIO, J.,** Synthesis of amines of high molecular weight for the liquid-liquid extraction of uranium, 20: 43429

**LOPEZ-MENCHERO, E.,** Requirements and problems of high activity waste management at the Eurochemic reprocessing plant, 20: 45232

**LOPEZ PEREZ, Baldomero,** Technical and economic aspects of irradiated fuels, 20: 43435

**LOPEZ VARONA, J. L.,** Synthesis of amines of high molecular weight for the liquid-liquid extraction of uranium, 20: 43429

**LORDI, J. A.,** Estimates of nonequilibrium ionization phenomena in the inviscid Apollo plasma sheath, 20: 44861 (NASA-CR-596)

**LOTHE, J.,** Homogeneous nucleation and growth of droplets in vapors, 20: 43674

**LOTTS, A. L.,** Remotely operated equipment for fabricating HFIR target elements, 20: 45204 (ORNL-P-2410)

**LOTZ, Waltraud,** Comparison of methods of measuring radioactivity (total $\beta$) in river water, 20: 43601

**LOTZ, Wolfgang,** Empirical formula for the electron impact ionization cross section, 20: 44110 (IPP-1/50)

**LOTZ, Wolfgang,** Ionization potentials of atoms and ions from H to Ni (Z = 28), 20: 43169 (IPP-1/49)

**LOUGHMAN, William D.,** Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)

**LOVE, T. A.,** Differential cross sections for production of protons in reactions of 160-Mev protons on complex nuclei, 20: 44649 (ORNL-3887)

**LOWTON, R. J.,** Dilution, dispersion, and sedimentation in some British estuaries, 20: 45224

**LU, E. Y. C.,** Spin and statistics in S-matrix theory, 20: 44332

**LUCAS, Jacques,** Magnetic study of sulfides and oxysulfides of U and K, 20: 43207

**LUEBELSMEYER, K.,** Single photoproduction of neutral $\pi$-mesons on hydrogen at small angles between 1.3 and 3 Bev, 20: 44242

**LUEDKE, Werner,** Absorption, fluorescence, and bleaching of pure and activated Cd fluoride crystals, 20: 45006

**LUKIERSKI, J.,** Canonical formalism for double pole, 20: 44292

**LUKIERSKI, J.,** Degeneracy of physical vacuum in vector meson theories with conserved current, 20: 44325

**LUKYANCHIKOVA, N. B.,** Device for spectral measurements of 1-f photocurrent noises in semiconductors, 20: 43653

**LUNDY, T. S.,** Effect of alpha bombardment on the diffusion of lead in silver, 20: 44002

**LUNEV, Z. M.,** Adsorption capacity of zeolites, 20: 43499

**LUOMA, W. L.,** Prog. rpt. on emissivity of materials, semiannual, 11/65–5/66, 20: 43816 (PWA-2877)

**LURIE, D.,** Generalized Ward identity and unified treatment of conservation laws, 20: 44320

**LURIE, Joan,** Nuclear magnetic resonance local-magnetic-field shift in solid xenon, 20: 44143

**LURIO, Allen,** Hyperfine structure $^2D_{5/2}$ and $^4F_{9/2}$ states of $^{107}$Ag and $^{109}$Ag, 20: 44141

**LUSTE, G.,** Search for a baryon of positive strangeness, 20: 44195

**LUTSENKO, N. M.,** Histochemistry of protein compounds in ovaries of irradiated rabbits, 20: 42941

**LUTTINGER, J. M.,** New mechanism for superconductivity, 20: 44542

**LUTZ, D. E.,** Temperature-enthalpy diagram helps analyze nuclear reactor steam systems, 20: 45174

**LUTZ, H. F.,** Reaction $^{25}$Mg(d,p)$^{26}$Mg at 8.0 Mev, 20: 44725

**LUTZ, H. R.,** Slightly enriched uranium single-rod heavy-water lattice studies, 20: 45084

**LYAPIN, V. V.,** Separation coefficients of $^{12}$C and $^{14}$C by equilibrium evaporation of methane, 20: 43093 (BNL-tr-84)

**LYATKOVSKAYA, N. M.,** Natural neutron background of the atmosphere and earth crust, 20: 43547

**LYKHIN, V. M.,** Effects of admixtures on radiolysis of potassium nitrate, 20: 43329

**LYMPERES, C. J.,** Nb-1 Zr alloy Li corrosion loop tests, 20: 43837 (TIM-823)

**LYNK, E. T.,** Energy loss and straggling of alpha particles in metal foils, 20: 44144

**LYNN, J. E.,** Measurement of the variation of the ratio of fission to absorption in $^{235}$U between 1 and 100 ev incident neutron energy, 20: 44648 (NRDC-117)

**LYON, J. F.,** Present status and objectives of DCX-2 experiment, 20: 44856 (ORNL-4011)

**LYS, J.,** Interactions $K^0$-p and S-wave kaon-nucleon scattering lengths, 20: 44244

**LYS, L. A.,** Heat-transfer measurements on compressed powders for reactor pressure-tube insulation, 20: 45056

**LYSOV, V. A.,** Theory of $\beta$-decay in the external magnetic field, 20: 44274

**LYUBIMOV, G. A.,** Hydraulic approximation for calculation of MHD flows through channels, 20: 44407

**LYUBITOV, Yu. N.,** Mass-spectrometer outfit for studying intensity distribution of molecular beams in space, 20: 43658

## M

**MA, Benjamin M.,** Radiation growth and swelling analysis for cylindrical fuel elements during a positive reactor period, 20: 44017

**MAC DONALD, R. I.,** Revision of the Harwell $^{240}$Pu source strength and $\bar{\nu}$ for $^{235}$U and $^{252}$Cf, 20: 44594

**MACHARADZE, T. S.,** Energy spectra and angular distributions of nucleons in three-particle photodisintegration of the $^3$He nucleus, 20: 44711

**MACHARADZE, T. S.,** Photodisintegration of the $^3$He and $^3$H nuclei, 20: 44823

**MACHIDA, Shigeru,** Electromagnetic structure of the nucleon with many-particle structure, 20: 44269

**MACHLIN, Irving,** Oxidation resistant structural metals for high temperature applications, 20: 43842

**MAC INTYRE, S. A.,** Comparative condensation pressure analyzer for uranium hexafluoride purity, 20: 43101

**MAC KELLAR, A. D.,** Dependence of Brueckner-Hartree-Fock calculations for light nuclei on details of the nucleon-nucleon interaction, 20: 44652 (ORNL-P-2468)

**MAC QUEEN, K. F.,** Effect of $\gamma$ rays on storage life and chipping qualities of Ontario grown Kennebec potatoes, 20: 43773

**MACRIS, B.,** Data on radiosensitization of fruit-spoilage fungi by chemical sensitizers, 20: 43784

**MAC VICAR, J.,** Effect of therapeutic radiation on serum and urine $\beta$-glucuronidase, 20: 43025

**MADDOX, W. E.,** Calcium-40(d,p)$^{41}$Ca proton polarization near the j-dependent cross-section minimum, 20: 44839

**MADELMONT, C.,** Potassium concentrations of milk from various provinces, 20: 43597

**MADSEN, B. S.,** Single-particle widths in $^{207}$Pb(pp) and (pp′) for isobaric analogue state of the ground state of $^{206}$Pb, 20: 44798

**MADSHUS, Kjell,** Excretion of radionuclides (investigations on radiocesium), 20: 42786

**MAEKAWA, Seihei,** Sample combustion apparatus for liquid scintillation counting, 20: 43139

**MAEKELAE, P.,** Strontium-90 in Finnish and some imported cereals during the harvest period 1963-64, 20: 43006

**MAFFEI, H. P.,** Failure of coextruded Zircaloy-2 clad uranium fuel elements during static autoclave testing, 20: 43828 (HW-66911)

**MAGANOVA, N. B.,** Metabolism of vitamins in dogs fed meat products pasteurized by $\gamma$ irradiation, 20: 42793

**MAGGI, G.,** Modification of duration of physiologic activity of insulin subjected to labeling with $^{131}$I, 20: 42760

**MAGGI, G.,** Modification of biologic activity of labeled insulin, 20: 42761

**MAGLIC, B. C.,** Structure within the R(1675) boson and possible structure within the $A_2$(1290), 20: 44245

**MAGRATH, N. A.,** World and Canadian energy: today and tomorrow. II., 20: 45184

**MAHANTHAPPA, K. T.,** $SU_6$ algebra of Gell-Mann and four-pion coupling constant, 20: 44336

**MAHER, R.,** Recovery of $^{233}$U from irradiated thoria, 20: 43415 (ISO-SA-3(Rev.))

**MAHONEY, Jeannette,** Test of a microscopic description of nickel isotopes by inelastic proton scattering, 20: 44658 (UCRL-16984)

**MAISKII, I. N.,** Biological effect of space-flight factors using lysogenic bacteria, 20: 42911

**MAISKII, I. N.,** Biological studies carried out in satellites, 20: 42912

**MAISKII, I. N.,** Phage production of E. coli induced during flights of Vostok-3 and Vostok-4, 20: 42910

**MAJALI, A. B.,** Production of carrier-free $^{32}$P, 20: 43389

**MAJER, Jaroslav,** New complexans. VI., 20: 43204

**MAK, Bing Kwong,** Proton microanalysis, 20: 43127

**MAKARENKO, I. N.,** Thermal properties of molybdenum at elevated temperatures, 20: 43977

**MAKAROV, D. V.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)

**MAKAROV, E. F.,** Nuclear $\gamma$ resonance on highly dispersive Sn, 20: 44149

**MAKAROV, V. M.,** Leakage discovery in Na–$H_2O$ steam generator, 20: 45059

**MAKI, A. H.,** Temperature dependence of fluorine and $^{13}$C hyperfine interactions of hexakis(trifluoromethyl)benzene anion, 20: 43225

**MAKI, K.,** Tomasch effect as a probe of the dispersion relation of electrons in "gapless" superconductors, 20: 44547

**MAKINO, M. Q.,** Effect of $Z = 28$ shell closure on proton total reaction cross sections, 20: 44662 (USC-136-111)

**MAKSIMOV, I. N.,** Study of the content of long-lived fission-fragment radionuclides in the Black Sea, 20: 45227

**MAKSIMOV, N. A.,** Mass-spectrometric method of analysis of isotope content of O in phosphates in $H_2O$, 20: 43146

**MAKSIMOV, V. L.,** Automatic magnetic field calibrator for EPR microwave spectrometers, 20: 43720

**MAKSIMOVA, G. N.,** Singular changes in protein metabolism during partial-body exposure to x radiation, 20: 42939

**MAKSYUTENKO, B. P.,** Delayed neutrons at fission threshold of $^{232}$Th, 20: 44672 (LA-tr-66-34)

**MAKSYUTENKO, B. P.,** Delayed neutrons and (n,nf) reaction in U isotopes, 20: 44670 (INDSWG-101, pp 158-63)

**MALAISE, Edmond,** Growth of cells from irradiated experimental fibrosarcoma of C3H mice, 20: 42888

**MALAVIYA, B. K.,** Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)

**MALCIC, K.,** Effect of local irradiation of head of rats in infantile period on spermatogenesis, 20: 42961

**MALECKI, Andrzej,** Transverse sum rule for electrons scattered inelastically with large momentum transfers from light nuclei, 20: 44636 (INP-479/PL)

**MALLETT, Gavin R.,** Conference on applications of x-ray analysis, Denver, 8/65, 20: 43267

**MALOV, L. A.,** Energies of the octupole states of even-even nuclei in the energy region $228 \leq A \leq 254$, 20: 44751

**MALSEED, C. F. S.,** Removal of superconducting surface-sheath by copper-plating, 20: 44530

**MAL'TSEV, M. V.,** Production technology of Nb and Nb alloys, 20: 43984

**MALUSZYNSKA, K.,** Energy and angular distribution of neutrons from $^7$Li(d,n)$^8$Be reaction at 200 kev, 20: 44677

**MALYAVKIN, L. P.,** Stabilized power supply for electron-optical converters, 20: 43656

**MALYKHIN, V. M.,** Precision of radon estimation in human body, 20: 43604

**MAMALADZE, Yu. G.,** Quantization of macroscopic motions and hydrodynamics of rotating He II, 20: 44563

**MAMANTOV, Gleb,** Voltammetry and related studies of U in molten LiF–$BeB_2$–$ZrF_4$, 20: 43099

**MAMASAKHLISOV, V. I.,** Energy spectra and angular distributions of nucleons in three-particle photodisintegration of the $^3$He nucleus, 20: 44711

**MAMASAKHLISOV, V. I.,** Photodisintegration of the $^3$He and $^3$H nuclei, 20: 44823

**MAMURO, T.,** Dehydration of radioactive slimes, 20: 45218 (KFK-tr-201)

**MAMURO, Tetsuo,** Radioactive fallout particles from the Chinese nuclear explosion test. II., 20: 43528

**MANFREDINI, S.,** Absorption of fission products by marine organisms, 20: 42770

**MANGAN, M. A.,** Connecticut Yankee set point study, 20: 45115 (NYO-3250-7)

Manh, Pham Tu
*see* *Pham Tu Manh*

**MANI, R. S.,** Preparation of special radioisotope labeled compounds at Trombay, 20: 43397

**MANI, R. S.,** Preparation of useful radioisotopes of high specific activity, 20: 43398

**MANI, R. S.,** Preparation of $^{51}$Cr of high specific activity for medical use, 20: 43401

**MANI, R. S.,** Production of carrier-free $^{32}$P, 20: 43389

**MANN, H.,** Properties of partial radiation widths in $^{196}$Pt, 20: 44807

**MANNING, D. L.,** Voltammetry and related studies of U in molten LiF–$BeF_2$–$ZrF_4$, 20: 43099

**MANSON, N.,** Properties of collision and combustion waves and possibilities of their application to energy conversion, 20: 44174

**MANSUI, Guy,** Method of biological and medical exploration: ionography calibrated in roentgens, 20: 43028

**MANTEL, T. D.,** Pulsed transmission and ringing phenomena in a warm magnetoplasma, 20: 44944

**MARAVIGLIA, B.,** Measurement of a barrier for the extraction of excess electrons from liquid helium, 20: 44556

**MARCHAL, Jean,** Radiation cross-linking of polyoxyethyleneglycol in aerated aqueous solution, 20: 43375

**MARCHAL, Maurice,** Method of biological and medical exploration, ionography calibrated in roentgens, 20: 43028

**MARCHENKO, V. I.,** Sulfides of rare earth metals and actinides, 20: 43264

**MARCU, Gheorghe,** Analysis of Cu sulfate solutions by the $\beta$ radiation reflection method, 20: 43142

**MARCU, Gheorghe,** Behavior of $^{152}$Eu, $^{147}$Pm, $^{241}$Am, and $^{246}$Cm in Na hexametaphosphate medium in paper electrophoresis and separation of $^{95}$Zr and $^{134}$Cs, 20: 43451

**MARCUS, F.,** Requirements and problems of high activity waste management at the Eurochemic reprocessing plant, 20: 45232

**MARCUS, S. M.,** Structure in the $d^2V/dI^2$ versus V characteristic of Pb-insulator-metal tunnel junctions, 20: 44533

**MARGRAFF, R.,** Szilard-Chalmers effects in solid Xe compounds, 20: 43373

**MARGRAVE, J. L.,** First ionization potentials of Sa, Eu, Gd, Dy, Ho, Er, Tm, and Yb by electron-impact method, 20: 43235

**MARION, Jerry B.,** Accelerator calibration energies, 20: 44062

**MARIS, Th. A. J.,**Goldstone's theorem and partially conserved currents, 20: 44334

**MARKAKIS, P.,** Radiation-induced calcium release from plant tissues, 20: 42916

**MARKEE, E. H. Jr.,** Environmental effects from operation of the waste calcination facilities, 20: 45219

**MARKEZICH, Anthony R.,** Radiation-induced interaction of styrene with cotton, 20: 43349

**MARKIV, V. Ya.,** Ternary chemical compounds Ni–Ti–Nb system, 20: 43971

**MARKOV, K. P.,** Monitoring U mine atmospheres for short-lived daughter products of Rn, 20: 43594 (AEC-tr-6763)

**MARKS, Darrell Lee,** Effects of irradiation on metabolism of glucose in rat, 20: 42856 (TID-23213)

**MARLOW, P. G.,** Raman scattering in uranium dioxide, 20: 45015

**MARMIER, P.,** Direct determination of a short nuclear lifetime ($\approx 10^{-20}$s) by the proximity scattering method, 20: 44731

**MARNET, C.,** Fuel elements (AVR), 20: 45135

**MARSH, James S.,** Ising chain statistics and magnetic phases in rare earth trichlorides, 20: 43176 (NP-16302)

**MARSH, W. D.,** Economic use of nuclear power in expanding utility systems, 20: 45178

**MARSHALL, L.,** New $T \geq 1$ Di-pion at 965 Mev, 20: 44229

**MARSHALL, H. H.,** Analytical descriptions of the sub-cadmium cross section of $^{233}$U, $^{235}$U, $^{239}$Pu, and $^{241}$Pu, 20: 44629 (CONF-660303, pp 985-96)

**MARSHALL, N. H.,** Fission cross section of $^{241}$Pu from 20-200 ev as determined from a nuclear explosion, 20: 44625 (CONF-660303, pp 910-18)

**MARSHALL, R. W.,** Prog. rpt. on radiation effects on microelectronic circuits, 2–4/66, 20: 43753 (AD-636773)

**MARSHALL, S. A.,** Electron spin resonance absorption spectrum of the $AsO_3^{2-}$ molecule ion in $\gamma$-irradiated single-crystal calcite, 20: 45010

**MARTIN, J. H.,** Dilution, dispersion, and sedimentation in some British estuaries, 20: 45224

**MARTIN, Jean-Claude,** Ecosystem in the coastal waters of the Ligurian Sea. II., 20: 42734

**MARTIN, M.,** Structure within the R(1675) boson and possible structure within the $A_2$(1290), 20: 44245

**MARTIN, M. J.,** Revised A chains. A = 188, 20: 44715

**MARTIN, Malcolm A.,** Thermal stabilities and species specificities of reannealed animal DNA, 20: 42757

**MARTIN, T. C.,** Separation of isotopic interferences utilizing Ge(Li) gamma ray detectors, 20: 43081 (ORO-2980-13)

**MARTIN, W. H.,** Mechanism of dimensional changes in crystals of graphites and carbons under fast-neutron irradiation, 20: 44020

**MARTIN, W. R.,** Irradiation embrittlement of welds and brazes at elevated temperatures, 20: 44027

**MARTIN, W. R.,** Solutions to the problems of high-temperature irradiation embrittlement, 20: 43999 (ORNL-TM-1544)

**MARTINELLE, Sten,** Solar cycle variation in the attenuation length of the cosmic ray nucleon component, 20: 44425

**MARTINENGHI, C.,** Response to radiotriolein test in adults and aged persons, 20: 42782

**MASCHKE, A.,** $\bar{p}p$ elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263

**MASE, Hiroshi,** Positive column in a very strong magnetic field, 20: 44917

**MASHIKO, Kikyuo,** Absorption and excretion of Ca by teleost fishes, 20: 42750

**MASLOVA, A. F.,** Acetylcholine metabolism in sympathetic ganglion of irradiated rabbits, 20: 42875

**MASON, T. R.,** Heated glass cathodes in electrostatic beam separators, 20: 44046

**MASSA, D.,** Radiation inactivation of foot and mouth disease virus, 20: 42954

**MASSALSKI, J.,** Generation of the high-energy nucleon-electron cascade by means of the program written for the small computer, 20: 44152

**MASSALSKI, J.,** Program for the interpolation of the cascade curves with the aid of a small electronic computer, 20: 44153

**MASSEY, Louis M. Jr.,** Prog. rpt. on biochemistry and physiology of irradiated fruits and vegetables, annual, 9/65–9/66, 20: 42851 (NYO-3274-9)

**MASSUCCI, Maria Antonietta,** Fluorescence of lanthanum ions in aqueous solutions. I., 20: 43210

**MASSUCCI, Maria Antonietta,** Fluorescence of lanthanum ions in aqueous solutions. II., 20: 43211

**MASSUCCI, Maria Antonietta,** Fluorescence of lanthanum ions in aqueous solutions. III., 20: 43212

**MASTEL, B.,** Defect structures in neutron irradiated nickel, 20: 43990 (BNWL-SA-782)

**MASTEL, B.,** Deformation structure of neutron-irradiated Cu–Al alloy, 20: 44003

**MATCHAL, Marie-Therese,** Method of biological and medical exploration: ionography calibrated in roentgens, 20: 43028

**MATEESCU, N.,** Cold neutron scattering by liquid nitrogen, 20: 44598

**MATES, R. E.,** Estimates of nonequilibrium ionization phenomena in the inviscid Apollo plasma sheath, 20: 44861 (NASA-CR-596)

**MATEVOSYAN, E. M.,** Ionization measurements in streamer chamber, 20: 43691

**MATHE, G.,** Treatment of acute leukemia—actual and possible results, 20: 43045

**MATHER, D. S.,** Revision of the Harwell $^{240}$Pu source strength and $\bar{\nu}$ for $^{235}$U and $^{252}$Cf, 20: 44594

**MATHEWS, P. M.,** Recent contraction theorem for pseudo-orthogonal groups, 20: 44346

**MATHUR, V. S.,** Algebra of currents and the $K_1^0$-$K_2^0$ mass difference, 20: 44266

**MATLACK, G. M.,** Improvements in precise measurement of gamma activity, 20: 43074 (LA-DC-7831)

**MATLAK, T.,** Magnetic hyperfine structure of the $^{57}$Fe impurity nucleus, 20: 45033

**MATSUBARA, Hisao,** Effects of $\gamma$ irradiation on tulip. II., 20: 42861 (NSJ-tr-53)

**MATSUI, Hiroshi,** Quantometric analysis of rare earth elements in Mg alloys, 20: 43112

**MATSUI, Masao,** Radiolysis of a binary mixture of tetrahydrofuran with furan, 20: 43295

**MATSUMOTO, Takuya,** Effect of radiation on the spermatozoa, 20: 42950

**MATSUMURA, T.,** Dehydration of radioactive slimes, 20: 45218 (KFK-tr-201)

**MATTHEWS, M. D.,** Formation of channeling patterns on the surface of ion bombarded silicon, 20: 45022

**MATTHEWS, R. R.,** Fast reactors: on the line by '71, 20: 45172

**MATTHEWS, R. R.,** From the DFR to the PFR, 20: 45158

**MATTHIAS, B. T.,** Many more superconducting bismuth phases, 20: 44554

**MATTIOLI, Mario,** Allowed bands for wave generation through nonlinear effects in a plasma, 20: 44893

**MATUMOTO, Ken-iti,** Universality of the strong interaction of hadrons, 20: 44375

**MAUGER, Richard L.,** Argon-40 in cogenetic feldspar-mica mineral assemblages, 20: 43503 (COO-689-60, App. A-3)

**MAUGER, Richard L.,** Cenozoic argon ages on metamorphic rocks from the Basin and Range Province, 20: 43501 (COO-689-60, App. A-1)

**MAUGER, Richard L.,** Gamma-ray spectrometer studies of hydrothermally altered rocks, 20: 43507 (COO-689-60, App. A-7)

**MAUGEST, J.,** Radioisotopes used for measuring thickness in metallurgy, 20: 43642

**MAVRODIN, Maria,** Halogenomandelic acids, reagents for separation and determination of rare earths in presence of U(VI), 20: 43141

**MAXWELL, C. J.,** Alice machine tape-recorder data acquisition system, 20: 43638 (UCRL-70018)

**MAXWELL, J. R.,** Three L = 0 transitions in the $^{57}$Fe(p,t)$^{55}$Fe reaction, 20: 44756

**MAXWELL, R. L.,** Comparison of theoretical and experimental results from spherical shells with a single radially attached nozzle, 20: 43491 (ORNL-P-2472)

**MAYER, B.,** Elastic scattering of polarized deuterons by deuterium at 21.4 Mev, 20: 44231

**MAYFIELD, R. M.,** Improvements in consolidation and fabrication of V-20 wt.% Ti (TV-20), 20: 43846 (ANL-7127)

**MAYINGER, F.,** Prog. rpt. on pulsating burnout, final, 3/66, 20: 43478 (EURAEC-1620)

**MAYNARD, Glenn,** Bibliography on physical properties and phase diagrams of ten refractory oxides, 20: 43911 (UCRL-6262(Pt.1))

**MAYS, Charles W.,** Strontium-90 and $^{89}$Sr dose estimates for the fetus and infant, 20: 43605

**MAZEY, D. J.,** Formation of channeling patterns on the surface of ion bombarded silicon, 20: 45022

**MAZUMDAR, A. S. Ghosh,** Gamma radiolysis of Pu solutions in 0.8N sulfuric acid, 20: 43358

**MAZUMDAR, A. S. Ghosh,** Kinetics of reduction of tetravalent Pu by $H_2O_2$ in perchloric acid solutions, 20: 43245

**MAZURIK, V. K.,** Disturbance in thymine decay in irradiated rats, 20: 42806

**MAZURIK, V. K.,** Excretion of thymidine, desoxyuridine and $\beta$-amino-isobutyric acid in rats following irradiation and thymidine injection, 20: 42807

**MAZZANTI, G.,** Comparison between radiologic pictures and volumetric ventilatory data in pulmonary scleroses secondary to radiotherapy of bronchogenic neoplasm, 20: 43030

**MC ARTHUR, W. H.,** Prog. rpt. on $O_2$ consumption, $CO_2$ accumulation, and $N_2$ balance in mouse radiation chimeras, 1962–65, 20: 42854 (TID-23127)

**MC CAIN, Douglas Clayton,** Measurement of electron spin relaxation times of ions in aqueous solution, 20: 43184 (UCRL-17064)

**MC CAMAN, Richard E.,** Isotopic method for determining enzyme activity in microgram and submicrogram quantities of tissue, 20: 43118

**MC CLAIN, W. C.,** Model and underground studies of the influence of stress, temperature, and radiation on flow and stability in rock salt mines, 20: 45217 (ORNL-P-2126)

**MC CLATCHIE, E. A.,** T = 2 isobaric multiplet at mass 24, 20: 44758

**MC CORMICK, J. Frank,** Prog. rpt. on effects of ionizing radiation on plant species, 9/65–8/66, 20: 42853 (ORO-3299-1)

**MC CREDIE, J. A.,** Current trends in radiobiology, 20: 42821

**MC DONALD, Frank B.,** Extended source of energetic cosmic x rays, 20: 44095

**MC DONALD, J.,** Photomultiplier resolving time measurements utilizing a light pulse generator, 20: 43709

**MC DONALD, Larry W.,** Curve relating dose in time to pituitary histologic change following $\alpha$ irradiation, 20: 43016 (UCRL-16246, pp 58-65)

**MC DONALD, Larry W.,** Radiosensitivity of vestibular apparatus of rabbit, 20: 42858 (UCRL-16246, pp 74-83)

**MC DONALD, P.,** Silica gel chromatographic procedure adapted to liquid-scintillation counting of $^{14}C$-labeled organic acids, 20: 43125

**MC DONALD, T. J.,** Ultraviolet radiation and Moraxella bovis in etiology of bovine infectious keratoconjunctivitis, 20: 42863

**MC DOWELL, W. J.,** Interface and transferring species in amine extraction of uranium, 20: 43424 (ORNL-P-2359)

**MC ELROY, J. M.,** Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 $F^{-2}$, 20: 44253

**MC ELROY, W. N.,** Neutron flux spectral determination by foil activation, 20: 44579 (CONF-660303, pp 532-53)

**MC GOFF, D. J.,** Effects of prepoison cross section of uncertainties on SNAP reactor performance, 20: 45193 (CONF-660303, pp 204-9)

**MC GOODWIN, M. C.,** Use of lithium fluoride dosimeters for in vivo measurement of transmission through bone and lung, 20: 43747

**MC GRATH, E. J.,** Bias in nuclear reactor power spectral density estimates with finite record lengths, 20: 45091

**MC GRATH, R. L.,** Calcium-37 and the mass 37 T = $^3/_2$ quartet, 20: 44659 (UCRL-16990)

**MC GREGOR, Maurice,** Effect of coronary vasodilatation on myocardial distribution of tritiated water, 20: 42763

**MC INTOSH, Harold V.,** Degeneracy of cyclotron motion, 20: 44913

**MC INTOSH, J. D.,** Remote maintenance in a large scale separations plant, 20: 43417 (ISO-SA-25)

**MC KEREGHAN, Charles D.,** Design of a nuclear propulsion module, 20: 45200

**MC KINNEY, F. E.,** Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758

**MC LAMORE, V. R.,** Seismic velocity determination and distance measurements in salt dome, 20: 43551 (VUF-3015)

**MC LAUGHLIN, L. M.,** Hot pressing techniques for beryllium oxide, 20: 43863 (Y-1290)

**MC LENNAN, Ewen A.,** Density in N, O, and H afterglow plasmas, 20: 44852 (AD-629924)

**MC NAMEE, P.,** Leptonic decay of the hyperfragment $_{\Lambda}H^4$, 20: 44803

**MC NAUGHTON, G. S.,** Studies in radioactive fallout in New Zealand. III., 20: 43530

**MC NEILL, K. G.,** Human Ca metabolism using long-term whole body tracer measurements, 20: 42764

**MC RICKARD, S. B.,** Effect of interstitial impurities on radiation hardening and embrittlement in iron, 20: 44001

**MC SHERRY, Wilbur F.,** Radiation-induced interaction of acrylonitrile with cyanoethylated cotton, 20: 43348

**MC SHERRY, Wilbur F.,** Radiation-induced interaction of styrene with cotton, 20: 43349

**MEACHER, J. S.,** Prog. rpt. on gas-bearing Brayton cycle turbocompress 3–6/66, 20: 43481 (NYO-3237-6)

**MEADE, Dale M.,** Fluctuations in a plasma confined by a toroidal octupole magnetic field, 20: 44945

**MEAKER, R. E.,** Density and molar volumes of binary fluoride mixtures, 20: 43165 (BM-RI-6836)

**MEAKIN, J. D.,** Microstrain behavior of beryllium single crystals, 20: 43924

**MECHAM, W. J.,** Cost study of processing of oxide, carbide, and metal fa breeder-reactor fuels, 20: 43410 (ANL-7137)

**MEDANA, R.,** Isotopic mixing in hydrogen chemisorbed on polycrystalline tungsten, 20: 43255

**MEDNIKOV, A. K.,** Determination of depth of barrier window in N-I-P structure, 20: 43742

**MEDNIS, J.,** Neutron spectrum in a $UO_2$ tube at different temperatures, 20: 45089

**MEETZ, K.,** Application of spectral representations to the nonrelativistic and the relativistic Bethe-Salpeter equation, 20: 44298

**MEGAW, W. J.,** Counting, sizing, and sampling of Aitken nuclei in gas-cooled reactors, 20: 45055

**MEHLSEN, S.,** Problems involved in supply of natural and enriched U to users during period 1970–85, 20: 45118 (RISO-M-434)

**MEHRAN, A. R.,** In vivo intestinal absorption of L-alanine in irradiated rabbits, 20: 42972

**MEIER, R. W.,** Slightly enriched uranium single-rod heavy-water lattice studies, 20: 45084

**MEISTER, J.,** Trapping of the solar wind in solids. I., 20: 44697

**MEL, Howard C.,** Microelectrophoretic and enzymatic studies concerning carbohydrate at surface of rat erythrocytes, 20: 42714 (UCRL-16246, pp 119-25)

**MELE, A.,** Polymerization of tetrafluorethylene oxide, 20: 43301

**MELFI, F.,** Evaluating absorbed dose in gastrointestinal tract and liver from treatment with radioisotopes, 20: 43043

**MELICA, A.,** Comparison between radiologic pictures and volumetric ventilatory data in pulmonary scleroses secondary to radiotherapy of bronchogenic neoplasm, 20: 43030

**MELIK-GAIKAZYAN, I. Ya.,** Radiation-induced colors in deformed alkali-halide crystals, 20: 45041

**MELLO, P. A.,** Analysis of the BCS ground state for a charge-independent pairing interaction, 20: 44734

**MELNICK, M.,** GAM-TNS cross section library for the n+W reactions, 20: 44589 (WANL-TME-1472)

**MELTON, Charles E.,** Ionization of simple hydrocarbons, $H_2$, $D_2$, $O_2$, $H_2O$, and rare gases by 2.2-Mev $\alpha$ particles and by electrons, 20: 44122

**MEMMERT, G.,** Model studies on the prospects and consequences of the application of nuclear energy to electricity production. II., 20: 45128

**MERCEREAU, J. E.,** Normal Josephson junctions and quantum coherence, 20: 44551

**MERIEL, Pierre,** Neutron diffraction study of $U_2C_3$, 20: 45002

**MERIEL, Yves,** Attractions and disadvantages of heavy water nuclear reactors, 20: 45057

**MERKEL, B.,** Photodisintegration of $^6Li$ at high energy, 20: 44644 (LNF-66/32)

**MERKEL, P.,** Axisymmetric magnetohydrostatic equilibria, 20: 44858 (IPP-6/48)

**MERKER, L. G.,** Comparative costs of oxide and fuel elements, 20: 43849 (BNWL-273(Vol.1 and App.))

**MERKER, L. G.,** Effect on fuel element costs when certain reference values are varied, 20: 45095 (BNWL-273(Vol.3))

**MERMAZ, M.,** Evidence for an intermediate resonance in $^{26}Al$, 20: 44768

**MERRILL, John Raymond,** Aspects of helicon propagation in metals, 20: 44993 (NYO-2150-19)

**MERRITT, Charles Jr.,** Volatile compounds induced by irradiation in basic food substances, 20: 42973

**MESHCHERYAKOV, V. A.,** Chew-Low equations for $\pi N$ scattering, 20: 44281

**MESHITSUKA, Gisuke,** Effects of $\gamma$ irradiation on tulip. II., 20: 42861 (NSJ-tr-53)

**MESHITSUKA, Gisuke,** Observations of fallout in Tokyo. II., 20: 43518 (NSJ-tr-54)

**MESHKOV, S.,** Classification of the $Y_1^*(1765)$ and $Y_0^*(1520)$ resonances in the 1134 representation of SU(6), 20: 44258

**MESSELT, S.,** Energy levels in $^{14}N$ from $^{14}N(p,p')^{14}N$, 20: 44840

**METCALF, A.,** Industrial applications of neutron activation, 20: 43160

**METCALFE, Willam John,** Preparation of deutero-hydrocarbons, 20: 43409

**METZ, C. F.,** Improvements in precise measurement of gamma activity, 20: 43074 (LA-DC-7831)

**MEWE, R.,** Note on the singlet and triplet population in helium, 20: 44888

**MEYER, D.,** $\pi^+p$ Elastic differential cross sections from 2.3 to 4.0 Bev/c, 20: 44248

**MEYER, E.,** Pressure bonding of hollow thorium cores in aluminum cans, 20: 43861 (TID-12860)

**MEYER, Edgard,** Radiometric measurements in selected points of the island of Universitaria, near Guanabara, 20: 43548

**MEYER, Ph.**, Sum rules from the algebra of current densities, 20: 44326
**MEYER, V.**, Electron capture into the 2s-state of H in close $H^+$–He collisions, 20: 44138
**MEYER, W.**, New principles for quantization of relativistic field theories, 20: 44284
**MEYER-BERKHOUT, U.**, Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 $F^{-2}$, 20: 44253
**MEYEROTT, Arthur J.**, Resolution of x-ray sources at low galactic longitude, 20: 44091
**MEYERSON, Seymour**, Mass spectrometry of biosynthetically labeled ricinine, 20: 43382
**MEYERSTEIN, D.**, H/D isotope effects in formation of H from combination of two radicals in aqueous solutions, 20: 43352
**MEYNIEL, Gaston**, Effect of whole body irradiation by x rays on thyroid metabolism of rat, 20: 43029
**MICHAEL, B. D.**, Pulse radiolysis investigations of unimolecular elimination reactions in free radicals produced by OH addition to hydroxybenzenes, 20: 43332
**MICHALICA, Werner**, Question of daily rhythmic variations in radiation sensitivity in tumor-bearing mice and control animals, 20: 43048
**MICHALOWICZ, A.**, Measurement of the parameters D and R′ in proton-deuteron triple elastic scattering, 20: 44233
**MICHELI, J.**, Electromagnetic inelastic vertex, 20: 44208
**MICHELSEN, O. B.**, Beta decay of cerium isotopes far to the neutron-rich side of stability, 20: 43419 (LA-DC-7869)
**MICHON, G.**, Potassium concentrations cf milk from various provinces, 20: 43597
**MIDDELBOE, V.**, Half-lives $^{137m}$Ba, $^{109m}$Ag, and $^{106}$Rh measured with calculable overall accuracy, 20: 44712
**MIDDLEBROOKS, E. J.**, Radioactive decontamination by slurrying with Yazoo and Zilpha clays, 20: 45221
**MIDDLETON, R.**, Nuclear structure of $^{16}$N, 20: 44730
**MIESOWICZ, M.**, Central collisions of nucleons with heavy nuclei for energy higher than $10^{12}$ ev, 20: 44286
**MIGDAL, A. A.**, Spontaneous violation of strong interaction symmetry and the absence of zero-mass particles, 20: 44395
**MIHAILOVIC, M. V.**, Analysis of the low lying $0^+$ states in the middle weight nuclei, 20: 44647 (NIJS-R-484)
**MIHAILOVIC, M. V.**, Spectrometer for 14 Mev neutron capture spectroscopy, 20: 43708
**MIHAJLOVIC, Aleksandar**, Thermodynamic characteristics of self-diffusion in $\alpha$-uranium, 20: 43928
**MIKHAILOV, I. N.**, Calculation of nucleon-phonon interaction effects in a simple nuclear model, 20: 44638 (JINR-E-2772)
**MIKHAILOV, I. N.**, Method for solving the nucleon-phonon interaction problem, 20: 44678
**MIKHAILOVA, A. A.**, Effects of external $\alpha$-irradiation on intensity of growth of cells in vitro, 20: 42943
**MIKHALEVA, T. N.**, Determination of depth of barrier window in N-I-P structure, 20: 43742
**MIKHALEVA, T. N.**, Scintillation spectrometer for simultaneous investigation of competing nuclear reactions, 20: 43681
**MIKOSHIBA, N.**, Dispersion of transverse sound in superconductors, 20: 44536
**MIKULSKI, Andrzej T.**, HELENA codes for material buckling determination in subcritical assemblies, 20: 45073 (INR-659/IXA/RP)
**MILANI, C.**, Reactions $d(p,\gamma)^3He$ and $d(n,\gamma)^3H$, 20: 44748
**MILDVAN, Albert S.**, Pyruvate carboxylase. VI., 20: 42773
**MILETIC, B.**, Breakdown of RNA in E. coli after x irradiation, 20: 42814
**MILLARD, R. E.**, Effect of previous irradiation on transformation of blood lymphocytes, 20: 42903
**MILLER, A.**, Alterations of radiation effect on plants depending on cationic composition of nutrient medium, 20: 42915
**MILLER, D. W.**, Calcium-40(d,p)$^{41}$Ca proton polarization near the j-dependent cross-section minimum, 20: 44839
**MILLER, J.**, Deformation of the Ho nucleus, 20: 44710
**MILLER, L. F.**, Track effects in radiation-induced chemical reactions, 20: 43377
**MILLER, R. G.**, Decay of $^{34}$Ar, 20: 44759
**MILLER, R. R.**, High temperature PVT properties of Na, K, and CS, 20: 43944
**MILLER, R. R.**, High temperature vapor pressures of Na, K, and Cs, 20: 43945
**MILLER, R. R.**, High temperature specific volumes of liquid Na, K, and Cs, 20: 43946
**MILLER, Richard G.**, Reaction $^9Be(\alpha,n)^{12}C$, 20: 44723
**MILLER, T. E.**, Differential sensitivity of desynaptic and normal genotypes of barley to x-rays, 20: 42923
**MILLER, W. B. Jr.**, Critical organ exposure during fluoroscopy with analysis contributing parameters, 20: 43050
**MILLERTON, P. F.**, Pressure contacts between a superconductor and a normal metal, 20: 44526
**MILTON, D. W.**, Auroral-zone microbursts, 20: 44453
**MINASYAN, S. M.**, Changes in protein fractions of blood serum in irradiated rabbits injected with bone marrow, 20: 42870
**MINC, Stefan**, Primary processes in radiation chemistry as studied by mass spectrometry. VII., 20: 43335
**MINEEV, V. I.**, Coherent bremsstrahlung radiation of 15-Mev electrons in a silicon monocrystal, 20: 45020
**MINEEV, Yu. V.**, Telemetering of pulses from scintillating cosmic ray detector over wide dynamic range, 20: 43687
**MINER, W. N.**, Effects of 2 at.% rare-earth additions on $\gamma \rightleftarrows \alpha$ transformation of Ce, 20: 45011
**MINER, W. N.**, Stability of delta-phase Pu–Ga alloys, 20: 43895 (LA-DC-7934)
**MINIER-CASSAYRE, C.**, Point defects by neutron bombardment in iron containing impurities, 20: 45039
**MININA, N. Ya.**, de Haas-Van Alphen effect in Sb at ultralow temperatures, 20: 44569
**MIRNOV, C. B.**, Thermal insulation of plasma in Tokamak, 20: 44873 (MATT-Trans-35)
**MISCHKE, R. E.**, Experimental investigation of CP violation in $K_{2}^{0}$ decays, 20: 44259
**MISCHKE, R. E.**, Test of time-reversal invariance of $K_{1}^{0} \to \pi^- + \mu^+ + \nu$, 20: 44252
**MISHCHENKO, S. A.**, Effect of chlorine on spectra of rare earth elements in flame, 20: 43152
**MISHIMA, Yoshitsugu**, Improved testing device for measuring tangential expandability of beryllium tube, 20: 43960
**MISHRA, N.**, Calculation of the number of muons at sea-level in a photon-electron cascade initiated by a primary photon of energy $10^{14}$ ev, 20: 44160
**MISLOW, Kurt**, Determination of optical purity by nuclear magnetic resonance spectroscopy. II., 20: 43254
**MISRA, P.**, Dielectric function of degenerate electron gas in steady magnetic field, 20: 44904
**MISRA, Sushil K.**, Intermediate-state reorientation of oriented nuclei, 20: 44688
**MITANI, Masao**, Superconducting transition temperatures of lead alloys, 20: 44515
**MITCHELL, F. A.**, Decreased radiation mortality in dogs treated with typhoid-paratyphoid vaccine, 20: 42987
**MITCHELL, H. H.**, Plague in the United States: assessment problem following thermonuclear war, 20: 43587 (RM-4968-TAB)
**MITCHELL, H. H.**, Survey of infectious disease problem as it relates to post-attack environment, 20: 43588 (RM-5090-TAB)
**MITCHELL, M. A.**, Superconducting properties and anisotropic electrical resistivities of pure and cadmium-doped tin, 20: 44546
**MITCHELL, T. E.**, Dislocation arrangements in Ta single crystals deformed in tension at 373°K, 20: 43923
**MITCHNER, M.**, Prog. rpt. on direct-energy conversion systems, 3–5/65. I., 20: 44163 (AD-628528)
**MITIN, R. V.**, Cesium ionization under the simultaneous action of high pressures and temperatures, 20: 44979
**MITRA, A. P.**, Estimate of nitric oxide in D region, 20: 44436
**MITSUHASHI, Toshihiko**, Transitions of $^{90}$Sr and $^{137}$Cs concentrations in milk. II., 20: 43520
**MITTNER, P.**, Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230
**MITTS, Paul**, Radioprotective action of iproniazid, 20: 42991
**MIURA, Masaji**, Interaction of Ca, Ba, and La ions with built-up films of stearic acid and stearates, 20: 43238
**MIYAMOTO, Kenro**, Echelle monochromator and application to ion temperature measurement, 20: 44920
**MIZUSEKI, Hideo**, Interaction of Ca, Ba, and La ions with built-up films of stearic acid and stearates, 20: 43238
**MO, J. N.**, Low lying spin 1 state in $^{46}$Ti, 20: 44765
**MOCHIZUKI, K.**, KINAK: A code for one-dimensional, nuclear, thermal, and hydraulic calculation for BWR, 20: 45074 (JAERI-1107)
**MODJTAHED-ZADEH, R.**, Transition between rotational bands in $^{16}$O, 20: 44776
**MOEBIUS, P.**, Difficulties of the static quark model in the case of the $\eta$-decays, 20: 44235
**MOELLER, C.**, Survey of investigations on the energy-momentum complex in general relativity, 20: 44487
**MOESNER, J.**, Reaction $^{12}C(n,n')3\alpha$, 20: 44849
**MOH, Carl C.**, Prog. rpt. on application of nuclear energy to agriculture, triennial, 7/63–6/66, 20: 42850 (NYO-2043-130)
**MOHANTY, S. R.**, Kinetics of annealing of $\gamma$-irradiation damage in potassium bromate, 20: 43362
**MOHANTY, S. R.**, Solvent extraction of Th from hydrochloric acid solutions, 20: 43444
**MOHANTY, S. R.**, Thermal decomposition of irradiated thorium oxalate, 20: 43363

**MOHNEN, V.**, Investigations into attachment properties of radioactive aerosols, 20: 43167(BMwF-FBK-66-11)

**MOISEEV, S. S.**, Effect of ion motion along the magnetic field on plasma stability, 20: 44923

**MOKHIR, E. P.**, Finding optimum conditions in radioactivation analysis of binary systems, 20: 43149

**MOKOBODZKI, Gabriel**, Principle of maximum and minimum in potential theory, 20: 44300

**MOLDAUER, P. A.**, Effects of $(n,\gamma n')$ processes on fast neutron capture and nonelastic spectra, 20: 44614 (CONF-660303, pp 613-22)

**MOLIN, N.**, Clostridium botulinum, type E, in relation or irradiation treatment of fresh fish, 20: 43779

**MONAHAN, C. F.**, Low lying spin 1 state in $^{46}$Ti, 20: 44765

**MONOSI, A.**, Dose estimation to active bone marrow in medical uses of ionizing radiation, 20: 43620

**MONSON, H. O.**, Operational experience with breeding reactor EBR-II, 20: 45156

**MONTAGUE, D. G.**, Effect of $Z = 28$ shell closure on proton total reaction cross sections, 20: 44662 (USC-136-111)

**MONTALDI, E.**, Nonrelativistic nucleon-nucleon potential from S-matrix theory. II., 20: 44209

**MONTI, L. M.**, Effects of recurrent mutagenic treatment in durum wheat, 20: 42919

**MOORADIAN, A. J.**, Whiteshell Nuclear Research Establishment now and in the future, 20: 45183

**MOORE, C. F.**, Structure of the first three excited states in $^{208}$Pb, 20: 44787

**MOORE, M. S.**, Fission cross section of $^{241}$Pu from 20-200 ev as determined from a nuclear explosion, 20: 44625 (CONF-660303, pp 910-18)

**MOORE, M. S.**, Measurement and analysis of cross sections of fissile nuclides, 20: 44623 (CONF-660303, pp 840-72)

**MOORE, R. S.**, Interactions $K^0$-p and S-wave kaon-nucleon scattering lengths, 20: 44244

**MOORE, W. E.**, Polyethylene double differential inelastic scattering cross sections for epithermal neutrons, 20: 44576 (CONF-660303, pp 122-33)

**MORAN, J. F.**, Evaluation of quench correction in liquid scintillation counting, 20: 43675

**MORAND, M.**, Particles of abnormally long path emitted by $^{210}$Po, 20: 44686

**MORANO, E.**, Chemical protection of irradiated skin, 20: 42990

**MORAWETA, Herbert**, Polymerization in the crystalline state. IX., 20: 43323

**MORETTI, P. M.**, Epithermal fused-salt thorium breeder, 20: 45155

**MORGAN, I. L.**, Separation of isotopic interferences utilizing Ge(Li) gamma ray detectors, 20: 43081 (ORO-2980-13)

**MORGAN, J. G.**, Adaptation of ORNL M-GAM code for use at AI, 20: 44586 (NAA-SR-Memo-12019)

**MORGAN, W. C.**, Notes on the two-phase model for radiation-induced dimensional changes in graphite, 20: 44007

**MORGENSTERN, J.**, Properties of partial radiation widths in $^{198}$Pt, 20: 44807

**MORI, Kazuo**, Echelle monochromator and application to ion temperature measurement of He plasma, 20: 44920

**MORI, S.**, Crevice-galvanic corrosion of aluminum, 20: 43824 (ANL-6236)

**MORIGUCHI, Kin-ichi**, JP-Hydro: code for study of thermal-hydro dynamics in natural-circulation, BWR, 20: 43479 (JAERI-1108)

**MORITA, Itsuo**, Sample combustion apparatus for liquid scintillation counting, 20: 43139

**MOROZOV, V. A.**, Investigation of the decay scheme of $^{138*}$Pr, 20: 44643 (JINR-P-2819)

**MOROZOV, V. S.**, Radiation protection by mercaptoalkylamines and indolylalkylamines against $\gamma$ rays and proton beams, 20: 43002

**MOROZOV, Yu. L.**, Radiation-chemical synthesis of new mineral-organic ion-exchange materials, 20: 43311

**MORRIS, B. M.**, Dependence of Brueckner-Hartree-Fock calculations for light nuclei on details of the nucleon-nucleon interaction, 20: 44652 (ORNL-P-2468)

**MORRIS, James F.**, Plasma probes with guard rings and thermocouples, 20: 44862 (NASA-TM-X-1294)

**MORRISON, D. R. O.**, Interpretation of the variation of cross section with incident momentum for inelastic two body reactions, 20: 44359

**MORRISON, David L.**, Prog. rpt. on fission-product deposition and its enhancement under reactor accident conditions, 4–6/66, 20: 45045 (BMI-X-10173)

**MORRISON, G. C.**, Lowest $T = \frac{3}{2}$ state in $^{29}$P, 20: 44790

**MORRISON, G. W.**, Adjoint Monte Carlo calculations for enriched U metal assemblies, 20: 45076 (K-DP-1637)

**MORRISON, R. J.**, Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 $F^{-2}$, 20: 44253

**MORROW, P. E.**, Clearance of uranium dioxide dust from lungs following inhalation exposures, 20: 42767

**MORTIMER, D. C.**, Human Ca metabolism using long-term whole body trace measurements, 20: 42764

**MORTON, P. L.**, Wake fields of a pulse of charge moving in a highly conducting pipe of circular cross section, 20: 44052

**MORTON, R. J.**, Status Report No. 5 on Clinch River study, 20: 45216 (ORNL-3721)

**MORVAI, L.**, Well-logging in bauxite-prospecting neutron activation logging, 20: 43554

**MOSER, P.**, Point defects by neutron bombardment in iron containing impurities, 20: 45039

**MOSES, E.**, Search for a baryon of positive strangeness, 20: 44195

**MOSKALENKO, V. A.**, Determination of the critical temperature of superconductors with paramagnetic admixtures, 20: 44513

**MOSKALEVA, N. V.**, Phase composition and properties of alloys Mo–Ni–B system, 20: 43973

**MOSS, F. E.**, Measurement of a barrier for the extraction of excess electrons from liquid helium, 20: 44556

**MOULE, D. C.**, Determination of water in nonpolar liquids; solubility of water in benzene, 20: 43113

**MOULIN, Thiebaut**, Operation of plasma accelerators using progressive waves, 20: 44891

**MOVIN, A.**, Microangiographic studies on changes in cerebral vessels after irradiation. I., 20: 42862

**MOYER, Carl B.**, Coolant mixing in multirod fuel bundles, 20: 45051 (RISO-125)

**MOYZIS, J.**, Versatile high pressure Moessbauer apparatus, 20: 43732

**MOZER, F. S.**, Auroral-zone proton-electron anticorrelations, proton angular distributions, and electric fields, 20: 44442

**MOZER, F. S.**, Properties of auroral-zone electron source, 20: 44441

**MROZOWSKI, S.**, ESR in neutron-irradiated and doped graphite. II., 20: 44008

**MUCHA, Franciszek**, Investigations on the obtaining of spherical uranium dicarbide particles from uranium dioxide, 20: 43876

**MUELLER, H. W.**, Problems in the planning and construction of the AVR Research Nuclear Power Plant, 20: 45132

**MUELLER, Ilse**, Dependence of somatic mutation spectrum of Ephestia kuehniella of irradiated animal, 20: 42970

**MUELLER, N.**, Fuel development for a high-temperature fast reactor, 20: 45100

**MUELLER, R.**, Direct determination of a short nuclear lifetime ($\approx 10^{-20}$s) by the proximity scattering method, 20: 44731

**MUELLER, R.**, Tungsten oxide ($WO_3$): its growth and crystallographic investigations, 20: 43257

**MUELLER, William M.**, Conference on applications of x-ray analysis, Denver, 8/65, 20: 43267

**MUGNOZZA, G. T. Scarascia**, Effects of recurrent mutagenic treatment in durum wheat, 20: 42919

**MUHLEMAN, D. O.**, Radio propagation in the solar gravitational field, 20: 44096

**MUKHATOV, V. S.**, Influence of transverse currents on the equilibrium of toroidal plasma in the presence of conducting walls, 20: 44856 (IAE-1152)

**MUKHIN, I. E.**, Dependence of Ra content in vegetables and cereal on its concentrations in soils, 20: 42792

**MUKHTASIMOV, F. N.**, Investigation of the decay scheme of $^{138*}$Pr, 20: 44643 (JINR-P-2819)

**MUKHTASIMOV, F. N.**, New data on the conversion electron spectra of $^{153}$Dy, $^{155}$Dy, and $^{157}$Dy, 20: 44639 (JINR-P-2729)

**MUL'CHENKI, B. F.**, Plasma density spatial distribution measurements by multi-beam microwave probing, 20: 44857 (IAE-1153)

**MULFORD, R. N. R.**, Melting point and decomposition pressure of neptunium mononitride, 20: 43233

**MULLER, A.**, Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230

**MULLIKIN, T. W.**, Complete Rayleigh-scattered field within a homogeneous plane-parallel atmosphere, 20: 44075

**MUNARI, S.**, Kinetic features of radiation-induced polymerization of ethylene, 20: 43327

**MUNDSCHENK, H.**, Determination of peak locations of pure and complex photopeaks, 20: 44718

**MUNICIO, A. M.**, Synthesis of 4-aspartal-1 and 2-$^{14}$C, 20: 43273

**MUNTZ, James H.**, Determination of trace elements in W and Mo by atomic absorption spectrophotometry, 20: 43154

**MURAKAMI, Kazuaki**, Anisotropy of cosmic rays parallel to rotation axis of the earth, 20: 44475

**MURAKAMI, Kazuo**, Sample combustion apparatus for liquid scintillation counting, 20: 43139

**MURALIDHARAN, B.**, Photosynthesis of $^{14}$C labeled sugars, 20: 43402

**MURAMATSU, M.**, Effect of pH of solution on the contaminability by radioisotopes to skin, 20: 43010

**MURIN, G. F.**, Radiation protection by mercaptoalkylamines and indolylalkylamines against $\gamma$ rays and proton beams, 20: 43002

**MURPHY, Charles H.**, Ionospheric winds measured by gun-launched projectiles, 20: 44447

**MURTHY, T. S.,** Preparation of $^{204}$Tl sources from irradiated Tl metal, 20: 43400
**MURTHY, T. S.,** Recent improvements in chemical processing methods for radioisotopes, 20: 43399
**MUSAKIN, A. A.,** Basic exchange H reaction of nitrous heterocycles in liquid ammonia, 20: 43216
**MUSER, W.,** Shutdown equipment (AVR), 20: 45138
**MUSGRAVE, John R.,** Prog. rpt. on purification and crystallization of amorphous B powder, annual, 7/65-6/66, 20: 43090 (TID-23342)
**MUSIL, J.,** Measurement of radial distribution of electron density in plasma cylinder with multibeam microwave interferometer, 20: 44896
**MUSIN, A. K.,** Charged particle concentration waves in a moving plasma, 20: 44958
**MUSKALU, Shtefan,** Differential crossing of inelastic interaction of nucleon with deuteron, 20: 44275
**MUSSGNUG, Bernd,** Elastic scattering of 0.5-Mev gamma rays by heavy elements, 20: 44829
**MUSTO, R.,** Strong decay rates and SU$_3$, 20: 44331
**MUTO, Haruo,** Determination of O in Ti metal by fast neutron activation method, 20: 43111
**MYASNIKOVA, K. P.,** Ternary chemical compounds Ni–Ti–Nb system, 20: 43971
**MYASOEDOV, B. F.,** Separation of Pa from other elements by sorption on activated charcoal saturated with phenylarsonic acid, 20: 43148
**MYERS, Ira T.,** Neutron flux albedo for concrete, 20: 44988 (NASA-TM-X-1287)
**MYERS, Michael,** Heat treatment and mechanical properties of a U–2% Mo–2% Zr–2% Nb–0.5% Ti alloy, 20: 43883 (AD-637777)
**MYERS, T. R.,** Ion-exchange separation of kilocurie quantities of high purity Pm, 20: 43411 (BNWL-SA-677)
**MYERS, Wayne W.,** Amount and distribution of $^{86}$Rb transported into myocardium from ventricular lumen, 20: 42749
**MYRON, J. J. J.,** Radiolysis of ethyl mercaptan, 20: 43320

# N

**NABOKA, V. A.,** Interaction between plasmoids of a magnetic field of acute-angled geometry, 20: 44975
**NACHTWEY, D. S.,** Recovery from radiation injury in sheep, swine, and dogs as evaluated by split-dose technique, 20: 42996
**NAGASAKI, Rukichi,** Swelling of metallic uranium, 20: 43995 (JAERI-4037)
**NAGATA, Sinobu,** Quadruple correlation in the extra binding energy of the s-d shell nuclei, 20: 44818
**NAGLE, D. E.,** Characteristics and experimental program for an 800 Mev proton linear accelerator, 20: 44041 (LA-DC-8144)
**NAGOVITSINA, L. I.,** Dependence of Ra content in vegetables and cereal on its concentrations in soils, 20: 42792
**NAGY, Agnes G.,** Paper electrophoresis method for studying chemical forms of $^{131}$I in carrier-free preparations, 20: 43126
**NAHAVANDI, Amir N.,** Solution of nonlinear vibration problems in reactor components, 20: 45061
**NAHORNIAK, V.,** Cold neutron scattering by liquid nitrogen, 20: 44598
**NAIK, M. C.,** Grain boundary and lattice diffusion of silver in zirconium using tracer technique, 20: 43974
**NAIR, G. M.,** Study of Pu(III)–sulfate complexes, 20: 43244
**NAITO, Y.,** KINAK: A code for one-dimensional, nuclear, thermal, and hydraulic calculation for BWR, 20: 45074 (JAERI-1107)
**NAJZER, M.,** Spectrometer for 14 Mev neutron capture spectroscopy, 20: 43708
**NAKAGAWA, Ryozo,** Quantometric analysis of rare earth elements in Mg alloys, 20: 43112
**NAKAMURA, Seitaro,** Symmetry of strong and weak interactions, 20: 44379
**NAKAMURA, Sigeki,** Effect of pulsed x rays on a BF$_3$ counter, 20: 43756
**NAKANISHI, Yuh H.,** Unusual movement of daughter chromosome group in telophasic cells following irradiation, 20: 42895
**NAKAYAMA, Hideo,** Effects of internally deposited radionuclides on oral tissues of animals, 20: 42967
**NAKRA, A. N.,** Fuel cycles in PHWR and CANDU type reactors, 20: 45105 (AEET-252)
**NAKRA, A. N.,** Physics studies of prototype power reactor project, 20: 45104 (AEET-239)
**NAMIKI, Mikio,** Electromagnetic structure of the nucleon with many-particle structure, 20: 44269
**NANOBASHVILI, E. M.,** Radiolysis of dodecyl mercaptan, 20: 43345
**NARASIMHAM, N. A.,** Isotope shifts (C$^{32}$S–C$^{34}$S) in the bands of the A $^1\Pi$–X $^1\Sigma^+$ system of CS, 20: 43209
**NARLIKAR, J. V.,** Conformal theory of gravitation, 20: 44497
**NARLOCK, Raymond M.,** Method of polymerizing vinyl ethers, 20: 43379
**NARTEN, A. H.,** X-ray diffraction data on liquid water in temperature range 4 to 200°C, 20: 43180 (ORNL-3997)
**NASYROV, F.,** Penetration of $^{235}$U fission fragments through H$_2$, D$_2$, He, N$_2$, Ar, Kr, and Xe, 20: 44685
**NATARAJAN, K.,** Apparatus for thermal conductivity determination of organic coolants used in nuclear reactors, 20: 43270 (AEET-245)
**NATARAJAN, P. R.,** Gamma radiolysis of Pu solutions in 0.8N sulfuric acid, 20: 43358
**NATELSON, M.,** Space and energy effects in reactor fluctuation experiments, 20: 45081
**NATH, A.,** Estimation of the incoherent component in the measurement of coherent scattering of gamma rays at small angles, 20: 44147
**NATH, Amar,** Annealing behavior of neutron-irradiated tris-dipyridyl Co(III) perchlorate in hydrated form, 20: 43366
**NATHAN, A.,** Approaching nuclear power, 20: 45182
**NATORI, Makoto,** Structural model of the hydrated electron, 20: 43322
**NAUENBERG, M.,** Anti-matter in the earth's atmosphere, 20: 44037
**NAUMANN, Dieter,** Precipitation of uranium dioxide from alkali chloride melts, 20: 43185 (ZFK-WF-25)
**NAZARYAN, A. A.,** Ionization measurements in streamer chamber, 20: 43691
**NAZIROV, N. N.,** High yield of early maturing cottom under influence of $\gamma$- and neutron-irradiation, 20: 42899
**NEAGU, D. V.,** Operational program for V$^0$ events recorded in a Wilson chamber, 20: 43740
**NEAL, L. G.,** Prog. rpt. on kinetic studies of heterogeneous water reactors, 1–3/66, 20: 43484 (STL-372-38)
**NEAL, W.,** Gamma irradiation as means of extending storage life of haddock fillets, 20: 43770
**NEBGEN, K.,** Characteristics of the structural plant (AVR), 20: 45134
**NEDOKHA, I. M.,** Niobium: metal of the space age, 20: 43817 (JPRS-36718)
**NEDOVODIEV, E. V.,** Automatic magnetic field calibrator for EPR microwave spectrometers, 20: 43720
**NEDVEDYUK, K.,** Differential cross section of $^{16}$O(t,$\alpha$)$^{15}$N and $^{16}$O(t,p)$^{18}$O reactions at energy range from 0.6 to 1.75 Mev, 20: 44641 (JINR-P-2796)
**NEEF, William S. Jr.,** Mechanical design of the baseball coil and plasma-trapping chamber, 20: 44867 (UCRL-70026)
**NE'EMAN, Y.,** Consequences of an approximate C$_\nu$ invariance of the physical hadrons, 20: 44367
**NEF, C.,** Structure within the R(1675) boson and possible structure within the A$_2$(1290), 20: 44245
**NEFKENS, B. M. K.,** Experimental investigation of CP violation in $K_2^0$ decays, 20: 44259
**NEFKENS, B. M. K.,** Photoproduction and $\beta$-decay of $^8$He, 20: 44726
**NEFKENS, B. M. K.,** Test of time-reversal invariance in $K_1^0 \to \pi^- + \mu^+ + \nu$, 20: 44252
**NEIL, V. K.,** Wake fields of a pulse of charge moving in a highly conducting pipe of circular cross section, 20: 44052
**NELEPO, B. A.,** Determination of the rate of radioactive contamination of the Black Sea, 20: 43539
**NELEPO, B. A.,** Study of the content of long-lived fission-fragment radionuclides in the Black Sea, 20: 45227
**NELLES, H.,** Application of the Green function of Dirac's equation in electron scattering, 20: 44847
**NELMS, J. R.,** Simultaneous determination of Ca, Li, and K in high-purity ThO$_2$, 20: 43105
**NELSON, E. N.,** Laboratory investigation of recovery processes for pitchblende residues, 20: 43420 (MCW-1508)
**NELSON, R. S.,** Channelling of protons in ionic solids, 20: 45016
**NELSON, R. S.,** Formation of channeling patterns on the surface of ion bombarded silicon, 20: 45022
**NE'MAN, Y.,** Possible vanishing of strong interaction cross-section at infinite energies, 20: 44206
**NEMASHKALO, B. A.,** Measuring the energy of recharged particles in an electromagnetic trap, 20: 44976
**NEMCHENKO, Yu. S.,** Performance of 625-kJ battery using physical model, 20: 43458
**NEPOMNYASHCHII, Yu. A.,** Instability of Fermi systems and specific heat of liquid $^3$He, 20: 44516
**NESMEYANOV, An. N.,** Liquid-phase radiation-induced carboxylation of hydrocarbons with CO$_2$, 20: 43333
**NESTOR, C. W. Jr.,** Heating in infinite cylinders by uniform gamma sources, 20: 45050 (ORNL-TM-1260)
**NETHERCOTT, R. B.,** Removal of superconducting surface-sheath by copper-plating, 20: 44530
**NETO, Geraldo A. de Medeiros,** Evolution of exophthalmos associated with hyperthyroidism treated with radioiodine, 20: 42946
**NEUENSCHWANDER, E.,** Preparation and properties of ultrafine carbides, nitrides, and metals, 20: 43951
**NEUGEBAUER, Marcia,** Mariner 2 observations of solar wind. I., 20: 44078
**NEUHAEUSER, H.,** Strengthening mechanism in neutron-irradiated Cu single crystals. I., 20: 45031
**NEUMAN, William F.,** Prog. rpt., annual, 1965, 20: 42718 (UR-49-687)
**NEUMANN, L.,** Density of states in the gapless region of type-II superconductors, 20: 44525
**NEUMANN, M.,** Alteration of organic lacquer films by electron irradiation,

20: 43353
**NEUMANN, O.**, Fuel development for a high-temperature fast reactor, 20: 45100
**NEUSTROEV, G. V.**, Respiration of Salmo solar l. spawn in contaminated waters, 20: 42820
**NEUWIRT, Jan**, Effects of radiation doses on erythropoies of rats, 20: 42957
**NEVE DE MEVERGNIES, M.**, Spin measurement of the 8.8 ev neutron resonance in $^{235}$U by means of the resonant scattering method, 20: 44619 (CONF-660303, pp 755-62)
**NEVSTRUEVA, M. A.**, Problems of radiation hygiene, 20: 43602
**NEVZGODINA, L. V.**, Relative biological effectiveness of high-energy protons affecting cabbage seeds, 20: 42898
**NEWBOLD, H. L. R.**, Costs of large fossil fuel fired power plants, 20: 45242 (TID-22978(Rev.))
**NEWELL, Reginald E.**, Thermospheric energetic and a possible explanation of some observations of geomagnetic disturbances and radio aurorae, 20: 44465
**NEWMAN, D. J.**, Covalency in rare-earth trichlorides, 20: 43241
**NEWMAN, E.**, Distorted wave predictions of observed J dependence in the (d,$^3$He) reaction, 20: 44800
**NEWSON, H. W.**, Resonance structure above 100 kev, 20: 44612 (CONF-660303, pp 562-76)
**NGUYEN-NGOC, H.**, Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 F$^{-2}$, 20: 44253
**NICHIPORUK, B.**, Radiative unit and critical energy in Xe, 20: 44642 (JINR-P-2808)
**NICHOLS, F. A.**, Theory of radiation embrittlement and recovery of radiation damage in ferritic steels, 20: 44019
**NICHOLS, G. Starr**, Electrolytic preparation of uranous nitrate, 20: 43168 (DP-1065)
**NICKERSON, J. T. R.**, Quality and wholesomeness of radiation-pasteurized marine products, 20: 43768
**NICKLE, H. H.**, Nonrelativistic quantum theory of an electron in an arbitrarily intense laser field, 20: 44486
**NICOLAE, M.**, Discrimination of nuclear tracks in ionographic emulsion by electron microscopy, 20: 43731
**NICOLINI, J. O.**, Albumin macroaggregates labeled with $^{99m}$Tc, 20: 43390
**NIEBERGALL, F.**, Scattering of polarized neutrons by $\alpha$ particles, 20: 44732
**NIEDZWIEDZ, S.**, Moessbauer spectrometer calibration using $^{57}$Fe enriched metallic iron, 20: 43707
**NIEMIEC, J.**, Transition temperature of superconducting Tc–Re alloys, 20: 44559
**NIGROVIC, Vladimir**, Excretion of radionuclides (investigations on radiocesium), 20: 42786
**NIKITIN, M. D.**, Radiation protection during the flight in satellites "Voskhod I" and "Voskhod II", 20: 44990
**NIKKILAE, O. E.**, Strontium-90 in Finnish and some imported cereals during the harvest period 1963-64, 20: 43006
**NIKOLAEV, G. T.**, Pre-heated diffusion pumps, 20: 43498
**NIKOLAEV, G. T.**, Sputtering of stainless steel by $H_1^+$ ions, 20: 44131
**NIKOLIC, R. M.**, Solvent extraction of Fe(III) and U(VI) with mixtures of tri-n-octylamine and thenoyltrifluoroacetone in benzene and nitrobenzene, 20: 43434
**NIKOLSKAYA, E. B.**, Inactivation of alkaline phosphatase solutions by $\gamma$ irradiation and properties of irradiated phosphatase, 20: 42819
**NIKOL'SKII, I. K.**, Bremsstrahlung of a $\theta$-pinch plasma in the infrared spectral region, 20: 44984
**NIKONOV, A. P.**, Influence of x-rays on progeny of rats, 20: 42879
**NIKULIN, Jury Pavlovich**, Phantom for determining radiation doses, 20: 43053
**NILS, Albert**, Radioelements, factors of economic progress, 20: 43790
**NISAR, T.**, Interactions K$^0$-p and S-wave kaon-nucleon scattering lengths, 20: 44244
**NISHIDA, Yasushi**, Positive column in a very strong magnetic field, 20: 44917
**NISHITA, H.**, Gamma spectrometry of neutron-activated soils, 20: 43607
**NISTOR, V.**, Beam-plasma instability in the hollow cathode discharge, 20: 44937
**NITZSCHE, P.**, Absorption effect American explosion of July 9, 1962, on h-f at Norddeich-Neustrelitz, 20: 44479
**NITZSCHE, P.**, Ionospheric absorption of short waves during solar eclipse February 15, 1961. IV., 20: 44426
**NOBLE, Julian V.**, Application of multiparticle collision theory to the study of direct nuclear reactions, 20: 44654 (PUC-937-227)
**NOBLE, Julian V.**, Long-range perturbations of bound states and resonances, 20: 44802
**NOBUYUKI, Inoue**, Echelle monochromator and application to ion temperature measurement of He plasma, 20: 44920
**NOMURA, Y.**, Formation of tungsten and aluminum carbides by explosive shock, 20: 43952
**NOON, J. H.**, Radiation-temperature measurements on the nitrogen afterglow plasma, 20: 44942
**NOONAN, Thomas R.**, Radiation effects upon gastrointestinal absorption of water in rat, 20: 42971
**NORDBERG, Ulla-Brita**, Roentgen irradiation at 200 kv neoplasma of nasopharynx, 20: 43020
**NORRIS, E. B.**, Tensile and impact properties of LACBWR reactor vessel plate and control material, 20: 45120 (SWRI-1228-7-35)
**NOVAK, B.**, Resonance state for the induction acceleration of a cylindrical plasma cluster, 20: 44895
**NOVAK, Vladimir**, New complexans. VI., 20: 43204
**NOVAKOVA, E.**, Distribution of mitotic phases in erythroblasts in persons exposed to small doses of radiation, 20: 42884
**NOVEL, Madeleine**, Incorporation of radiosulfate between 13th and 18th day of development, in embryos of irradiated mice, 20: 42765
**NOVIKOV, G. I.**, Thermodynamic properties of rare earth chlorides with H and certain metals in gaseous state, 20: 43222
**NOVIKOV, I. D.**, Charge asymmetry and entropy of a hot universe, 20: 44080
**NOVIKOV, Yu. P.**, Separation of Pa from other elements by sorption on activated charcoal saturated with phenylarsonic acid, 20: 43148
**NOVOSELOVA, G. S.**, Radiation protection effect of apilac in animals, 20: 43009
**NOWAK, W.**, Phase shift of elastic scattering of high-energy electrons, 20: 44675
**NUSSINOV, S.**, Absorptive parts and the Bethe-Salpeter equation for forward scattering, 20: 44310
**NWACHUKU, C. Okechuku**, I-Excitation in $U_6 \otimes U_6$, 20: 44324

O

**OAE, Shigeru**, Oxygen exchange reaction of phenol in acidic media, 20: 43276
**OAKES, R. J.**, Leptonic decay of the hyperfragment $_\Lambda H^4$, 20: 44803
**OBAYASHI, Tatsuzo**, Measurement of ionospheric electron density by gyro-plasma probe, 20: 44476
**OBERKLUS, J.**, Complete installation of the AVR Reactor, 20: 45133
**OBERMAIR, G.**, Neutron spin asymmetry from spin-orbit scattering near a thermal absorption resonance, 20: 44780
**OBLIVANTSEV, A. N.**, Effects of admixtures on radiolysis of potassium nitrate, 20: 43329
**OCHI, Hironobu**, Comparison of biological effects of radiation of different energies. I., 20: 42817
**ODEHNAL, Milan**, Dynamic polarization of protons in $La_2Mg_3(NO_3)_{12} \cdot 24H_2O$ doped with $Dy^{3+}$, 20: 45004
**OECHSNER, H.**, Energies of neutral sputtered particles, 20: 44139
**OELGAARD, P. L.**, Fuel cycle investigations for a DOR-type reactor, 20: 45185
**OESTMAN, Bo**, Intensity recovery after Forbush decreases, 20: 44421
**OFFNER, H. G.**, Hydrolysis constant of quadrivalent cerium from spectrometric measurements, 20: 43189
**OFTE, D.**, Liquid Pu: a review of its unusual properties, 20: 43889 (CONF-660606-39)
**OGDEN, Eugene C.**, Twenty-four-hour dispersion of ragweed pollen from known sources, 20: 45235 (BNL-957)
**O'HARA, Martin J.**, Prog. rpt. on recrystallization and sintering of oxides, 9/65–8/66, 20: 43813 (COO-1122-3)
**OHTANI, S.**, Ingestion, excretion, and accumulation of fallout $^{137}$Cs in man, 20: 42794
**OHTSUBO, H.**, Muon capture in $^{16}$O and the possible existence of the induced tensor interaction, 20: 44767
**OI, Noboru**, Xenon-133 diffusion in UN single crystals, 20: 43981
**OINASE, D.**, Alterations of radiation effect on plants depending on cationic composition of nutrient medium, 20: 42915
**OKA, Mitsuru**, Effects of $\gamma$ irradiation on tulip. II., 20: 42861 (NSJ-tr-53)
**OKABE, Shigeru**, Angular distribution of backscattered electrons and backscattering coefficient, 20: 44115
**OKABE, Shigeru**, Anomalous secondary electron emission. I., 20: 44117
**OKABE, Shigeru**, Effect of pulsed x rays on a $BF_3$ counter, 20: 43756
**OKABE, Shigeru**, Energy distribution of backscattered electrons. II., 20: 44116
**OKABE, Shigeru**, Fluorine-19 ($\gamma$,n) cross section from threshold to 14 Mev, 20: 44683
**OKAMOTO, Shinichi**, Gamma-induced conductivity in insulating polymers. II., 20: 44997
**OKAMURA, S.**, Studies on radiation-induced ionic polymerization. I., 20: 43308
**OKAMURA, S.**, Studies on radiation-induced ionic polymerization. III., 20: 43338
**OKAMURA, S.**, Studies on radiation-induced ionic polymerization. IV., 20: 43339
**OKAMURA, Seizo**, Electron spin resonance study of radiation-induced solid-state polymerization of conjugated dienes, 20: 43325

**O'KANE, D. F.,** $Cr^{3+}$ and rare earth doped $LiNbO_3$, 20: 43242
**OKE, J. B.,** Photoelectric spectrophotometry of quasi-stellar sources, 20: 44071
**OKHAWA, T.,** Experimental observation of drift instabilities in toroidal plasma, 20: 44946
**OKRENT, David,** Cross section uncertainties and reactor safety, 20: 45068 (CONF-660303, pp 430-53)
**OLANDER, Farley,** Frequency dependence of the magnetization of Ho, 20: 44992 (IS-T-108)
**OLDEKOP, W.,** Heavy water reactor as a thorium breeder, 20: 45153
**OLDEKOP, W.,** Thorium breeders, 20: 45152
**OLDHAM, G.,** Installation of a 14 Mev neutron generator, 20: 44596
**OLEKSIUK, L. W.,** Properties of the 3.16-Mev level of $^{35}Cl$, 20: 44808
**OLENEV, V. I.,** Phosphorescence of proteins and aromatic amino acids subjected to uv radiation, 20: 42803
**OLETSKII, E. I.,** Effects of x irradiation on glycoprotein content of blood serum, 20: 42805
**OLIVAIN, Jack,** Allowed bands for wave generation through nonlinear effects in a plasma, 20: 44893
**OLIVE, D. I.,** Extraction of singularities from the S matrix, 20: 44319
**OLIVE, D. I.,** Icecream-cone singularity in S-matrix theory, 20: 44306
**OLIVE, D. I.,** Normal thresholds in subenergy variables, 20: 44305
**OLIVE, D. I.,** Spin and statistics in S-matrix theory, 20: 44332
**OLIVECRONA, Hans,** Roentgen irradiation at 200 kv of neoplasma of nasopharynx, 20: 43020
**OLSON, W. M.,** Melting point and decomposition pressure of neptunium mononitride, 20: 43233
**OLSZEWSKI, J.,** Explicit construction of the oscillator-like representations of the U(2,2) algebra in a spin basis, 20: 44288
**OLSZEWSKI, J.,** Oscillator-like representations of the U(N,N) algebras, 20: 44287
**OMAR, M. H.,** Oscillations in voltage between two weakly connected current-carrying superconductors, 20: 44561
**O'NEIL, Joseph W.,** Effect of W composition on mechanical properties of W–Ni–Fe heavy alloy, 20: 43885 (ASRL-TR-132-2)
**ONGARO, M. R.,** Electrification of polyethylene and polystyrene after $\gamma$ irradiation, 20: 43337
**ONO, Masayoshi,** Activation analysis of cancer, 20: 43138
**ONO, Ryoichi,** Activation analysis of cancer, 20: 43138
**OOSTENS, J.,** Production of isospin 1 resonances in the reaction $P + P = D +$ (missing mass), 20: 44243
**OPRESCU, E.,** Reactivation at low temperature of Sabin polyoviruses inactivated by x-rays, 20: 42966
**O'RAIFEARTAIGH, L.,** Strong decay rates and $SU_3$, 20: 44331
**O'REILLY, B. D.,** GRISM: code to generate multigroup constants from microscopic neutron cross section data, 20: 44584 (NAA-SR-11980 (Vol.3))
**OREN, O. H.,** Prog. rpt. on physico-chemical-biological processes affecting dispersion of radionuclides. I and II, final, 12/61–12/64, 20: 43508 (NP-16179)
**OREN, Yona,** $K_2^0p$ interactions at low momentum, 20: 44250
**O'RILEY, L. J.,** Radioisotopes as industrial tools in Canada, 20: 43763
**ORMEROD, M. G.,** Site of action of cysteamine in irradiated bacteria, 20: 42802
**OROPEZA, Ruben,** Effects of irradiation on lymphatic dynamics, 20: 42976
**ORSZAGH, A.,** Influence of $\gamma$-radiation on physico-chemical properties of linear saturated aliphatic polyesters. I., 20: 43342
**ORSZAGH, A.,** Influence of $\gamma$-radiation on physico-chemical properties of linear saturated aliphatic polyesters. II., 20: 43343
**OSBORN, R. K.,** Application of Langevin's technique to space- and energy-dependent noise analysis, 20: 45086
**OSBORN, R. K.,** Space and energy effects in reactor fluctuation experiments, 20: 45081
**OSHIMA, Yunosuke,** Dose calculation of $^{60}Co$ slab irradiator, 20: 43621
**OSTASHKOV, K. V.,** Singular changes in protein metabolism during partial-body exposure to x radiation, 20: 42939
**OSTERTAG, W.,** Rare earth graphite intercalation compounds, 20: 44999
**OSTERTAG, Werner,** Rare earth Co compounds with the $A_2B_{17}$ structure, 20: 43920
**OSTLIND, D. A.,** Effects of x-irradiation on development of Ascaridia galli, 20: 42968
**OSTROFF, Eugene,** Restoration of photographs by neutron activation, 20: 43344
**OTANI, Sadaichi,** Interaction of Ca, Ba, and La ions with built-up films of stearic acid and stearates, 20: 43238
**OTH, D.,** Suppression by x irradiation of syngenic preference phenomenon, 20: 42889
**O'TOOLE, J. D.,** Nuclear power-water desalting plant and the electric utility industry, 20: 45189
**OTSUKA, Masamoto,** Echelle monochromator and application to ion temperature measurement of He plasma, 20: 44920
**OTTER, J. M.,** GRISM, code to generate multigroup constants from microscopic neutron cross section data, 20: 44584 (NAA-SR-11980(Vol.3))
**OTTEWITTE, Eric H.,** Sensitivity of SNAP reactor calculations to uncertainties in Zr absorption cross section, 20: 45192 (CONF-660303, pp 88-90)
**OTTEWITTE, Erich H.,** Need for $^{238}Pu$ and $^{244}Cm$ cross section data, 20: 44628 (CONF-660303, pp 964-70)
**OVCHAR, L. A.,** Effect of chlorine on spectra of rare earth elements in flame, 20: 43152
**OVCHARENKO, L. I.,** Measuring the energy of recharged particles in an electromagnetic trap, 20: 44976
**OVCHINNIKOV, B. M.,** Spark chamber with acoustic spark location, 20: 43725
**OVCHINNIKOV, Yu. N.,** Boundary condition of the Josephson effect, 20: 44575
**OVCHINNIKOVA, L. P.,** Influence of ultraviolet radiation on nucleic acid content in Paramecium caudatum. I., 20: 42800 (ORNL-tr-1289)
**OVERLEY, J. C.,** Masses of $^{12}N$, $^{24}Al$, $^{28}P$, $^{32}Cl$, and $^{40}Sc$, 20: 44811
**OWEN, J. E.,** Fluidized bed recovery of F in manufacture of $UF_6$, 20: 43199
**OWENS, L.,** Prog. rpt. on intermetallic compounds for very high-temperature applications, 4–6/61, 20: 43886 (BBC-111)
**OXLEY, J. H.,** Fluidized-bed processing of particulate nuclear fuels, 20: 43868
**OYA, Hiroshi,** Measurement of ionospheric electron density by gyro-plasma probe: a rocket experiment by a new impedance probe, 20: 44476
**OZAKI, H.,** Dispersion of transverse sound in superconductors, 20: 44536
**OZAWA, K.,** Zero-phonon lines of color centers in LiF and NaF, 20: 45035
**OZMIDOV, R. V.,** Diffusion of soluble contaminants in the ocean, 20: 43541

# P

**PAATERO, P.,** Dead time correction of pulse height spectra with computer, 20: 43715
**PABBI, S. D.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458
**PACZYNSKI, Bohdan,** Integration of the equations of stellar structure, 20: 44099
**PADIOU, Jean,** Magnetic study of sulfides and oxysulfides of U and K, 20: 43207
**PAGE, N. P.,** Recovery from radiation injury in sheep, swine, and dogs as evaluated by split-dose technique, 20: 42996
**PAINE, R. M.,** Prog. rpt. on intermetallic compounds for very high-temperature applications, 4–6/61, 20: 43886 (BBC-111)
**PAISS, Y.,** High energy chemical reactions in gaseous phase, 20: 43291 (IA-1096)
**PAJARES, J. A.,** Multichannel analyzers for nuclear measurements, 20: 43641
**PAKKANEN, A.,** Self-contained system for stabilizing scintillation and semiconductor spectrometers, 20: 43712
**PAKULA, Roman,** Inactivation of solutions transforming DNA with aid of $\gamma$ radiation, 20: 42818
Palencia, Enrique Sanchez
*see Sanchez Palencia, Enrique*
**PALENZONA, D. L.,** Induction of new genetic variability for quantitative traits by seed irradiation, 20: 42846 (IAEA-2466-13)
**PALFREY, A. J.,** Absorption into rabbit articular cartilage, 20: 42772
**PALISTRANT, M. E.,** Determination of the critical temperature of superconductors with paramagnetic admixtures, 20: 44513
**PALLA, Gabriella,** Anomaly of small angle neutron scattering by $^{238}U$, 20: 44764
**PALLMER, P. G.,** Effect of chlorofluoromethanes on graphite oxidation, 20: 43839
**PALMAS, G.,** Absorption of fission products by marine organisms, 20: 42770
**PALMER, G. H.,** Aerosol studies and relevance of air sampling to personnel exposure in Pu laboratory, 20: 43630
**PALMER, P.,** Radio astronomical detection of helium, 20: 44081
**PALMER, R. B.,** Evidence against the existence of a strangeness +2 meson resonance at a mass of 1280 Mev, 20: 44262
**PALMER, Wilfred H.,** Effect of coronary vasodilatation on myocardial distribution of tritiated water, 20: 42763
**PALMIERI, A.,** Subcooled nucleate boiling with organic coolants, 20: 43486
**PALOMERO, C. Fernandez,** Building a power cell for the fuel handling machine for the DON Reactor, 20: 45163
**PALOMERO, C. Fernandez,** Fuel handling system of the DON Reactor, 20: 45162
**PALSHIN, E. S.,** Separation of Pa from other elements by sorption on activated charcoal saturated with phenylarsonic acid, 20: 43148
**PANASYUK, V. S.,** High-voltage nanosecond pulse generator, 20: 43655
**PANCHOLI, S. C.,** L subshell ratios of E2 transitions in deformed rare earth nuclei, 20: 44701
**PANCHVIDZE, M. V.,** Radiolysis of dodecyl mercaptan, 20: 43345
**PANDIT, L. K.,** Algebra of currents and the $K_1^0$-$K_2^0$ mass difference,

20: 44266

**PANEBIANCO, G.,** Conventional and high energy radiotherapy in treatment of malignant tumors of rhino-pharynx, 20: 43042

**PANFILOV, A. D.,** High-voltage nanosecond pulse generator, 20: 43655

**PANKOVE, J. I.,** Superconducting contacts in high magnetic fields, 20: 44531

**PANTELEEVA, N. S.,** Mass-spectrometric method of analysis of isotope content of O in phosphates and $H_2O$, 20: 43146

**PAPINEAU, A.,** Elastic scattering of polarized deuterons by deuterium at 21.4 Mev, 20: 44231

**PAPINEAU, A.,** Elastic scattering of polarized deuterons from $^4$He between 18 and 22 Mev, 20: 44750

**PAPINEAU, L.,** Evidence for an intermediate resonance in $^{26}$Al, 20: 44768

**PAPINI, G.,** London moment of rotating superconductors and Lense-Thirring fields of general relativity, 20: 44519

**PAPPAS, W. S.,** Comparative condensation pressure analyzer for uranium hexafluoride purity, 20: 43101

**PAQUIN, M. L.,** Prog. rpt. on vacuum foil-type insulation for radioisotope power systems, 5–7/66, 20: 43798 (ALO-3634-2)

**PAREKH, P. P.,** Isotopic analysis of Pb by neutron activation method, 20: 43134

**PARIBOK, V. P.,** Radioprotective actinn of inert gases and low molecular narcotics. V., 20: 43007

**PARISH, L. J.,** Structure of the first three excited states in $^{208}$Pb, 20: 44787

**PARK, David,** Introduction to strong interactions, 20: 44400

**PARKER, A. W.,** Measurement and analysis of high energy gamma-ray spectra, 20: 43702

**PARKER, C. V. Jr.,** Separation of isotopic interferences utilizing Ge(Li) gamma ray detectors, 20: 43081 (ORO-2980-13)

**PARKER, E. N.,** Dynamical state of the interstellar gas and field, 20: 44881

**PARKER, E. N.,** Nonsymmetric inflation of a magnetic dipole, 20: 44443

**PARKER, H. S.,** Prog. rpt. on ceramic materials for reactor applications, 7/61–6/62, 20: 43900 (NBS-D-150)

**PARKER, H. S.,** Prog. rpt. on ceramic materials for reactor application, 7/62–6/63, 20: 43901 (NBS-D-154)

**PARKER, P. D.,** Masses of $^{12}$N, $^{24}$Al, $^{28}$P, $^{32}$Cl, and $^{40}$Sc, 20: 44811

**PARKER, Peter D.,** Termination of the proton-proton chain via the $^7$Be(p,$\gamma$)$^8$B reaction, 20: 44076

**PARKER, Robert,** Determining response of temperature sensors to rapid temperature rise, 20: 43635 (UCRL-12484(Rev.2))

**PARKER, W. H.,** Experimental test of the Josephson frequency-voltage relation, 20: 44540

**PARKINSON, T. F.,** Differential and integral thermal-neutron spectra in $D_2O$-moderated lattices, 20: 45090

**PARKINSON, T. F.,** Neutron decay spectrometer, 20: 43745

**PARKS, G. K.,** Auroral-zone microbursts, 20: 44453

**PARLAG, A. M.,** Determination of oil–water interface based on delayed neutron detection, 20: 43553

**PARRISH, W.,** Ray proof slit mount for x-ray powder diffractometers, 20: 43661

**PASCUAL, P.,** Muon capture by $^3$He, 20: 44194

**PASCUAL, R.,** Muon capture by $^3$He, 20: 44194

**PASHLEY, J. H.,** Mechanically agitated fluid beds applied to hydrofluorination of UO powders, 20: 43198

**PASHLEY, J. H.,** Prediction of percentage conversion in two-stage fluid-bed hydrofluorination systems, 20: 43201

**PASKONOV, V. M.,** Calculation of the boundary-layer flow on an electrically conductive wall of a flat channel, 20: 44406

**PASKONOV, V. M.,** Computation of the boundary layer on the electrically conducting wall of a flat canal, 20: 44408

**PASSELL, L.,** Spin dependence of the reaction $^3$He(n,p)T and the nuclear susceptibility of adsorbed $^3$He, 20: 44804

**PASTERNACK, B. S.,** Procedure for calculation of gonadal x-ray dose in diagnostic radiography, 20: 43026

**PATE, Brian D.,** Reaction of recoiling silicon atoms with phosphine and silane, 20: 43315

**PATEL, V. L.,** Note on the propagation of hydromagnetic waves in the magnetosphere, 20: 44431

**PATERSON, J. E.,** Falling drop density analysis for relative concentrations of H and D in lithium deuteride, 20: 43089 (Y-1175(Del.))

**PATHAK, K.,** Observation of $^8$He among "hammer tracks" in nuclear emulsion, 20: 44747

**PATRICK, Jack W.,** Reaction channels in the capture of $K^-$-mesons by complex nuclei, 20: 44657 (UCRL-16602)

**PATT, Harvey M.,** Blood formation and blood cell depletion and recovery after irradiation, 20: 42845 (CONF-660543-1)

**PATTERSON, A.,** Radiation-induced peak effect in superconducting Nb–Zr, 20: 44505

**PATTERSON, J. F.,** Prog. rpt. on supercritical technology, 10–12/64, 20: 45098 (WCAP-3374-4)

**PATTI, Francois,** Simplified method for the determination of $^{90}$Sr in large amounts of bone ash, 20: 43061 (CEA-R-2998)

**PATTON, W.,** Proposed recoil technique for neutron-proton differential cross section measurements in the 15-30 Mev range, 20: 44632 (CONF-660303, pp 1084-91)

**PAULON, Jacques,** Operation of plasma accelerators using progressive waves, 20: 44891

**PAULUS, J.,** Influence of nature and energy of ion beam on gain of electron multiplier, 20: 43659

**PAVELESCU, D.,** Development of wear and the statistical aspect of radioactive isotopes measuring methods, 20: 43788

**PAVLENKO, V. A.,** High-sensitivity radio-frequency mass spectrometer for investigating ionic and neutral composition of upper atmosphere, 20: 43648

**PAVLICHENKO, O. S.,** Bremsstrahlung of a $\theta$-pinch plasma in the infrared spectral region, 20: 44984

**PAVLICHENKO, O. S.,** Drift instability of plasma discharge with oscillating electrons, 20: 44863 (NP-16310)

**PAVLOV, E. I.,** Inhibition of instabilities in a plasma column, 20: 44964

**PAVLOVA, Zh. K.,** Dependence of Ra content in vegetables and cereal on its concentrations in soils, 20: 42792

**PAVLOVA-VEREVKINA, A. I.,** Radioactive source of soft x radiation for physical investigations, technology, and medicine, 20: 43384

**PAVLYUKEVICH, T. M.,** Infrared spectra and structure of rare-earth phosphates and sulfates, 20: 43219

**PCHELINSKAYA, S. N.,** Influence of irradiation on properties of monocrystals of lithium fluoride, 20: 43307

**PEARLSTEIN, S.,** Cross sections for transuranium element production, 20: 44602 (BNL-982)

**PEARSON, John Edwin James,** Improvements in or relating to radioactive material containers, 20: 43475

**PECEVSKY, I.,** Breakdown of RNA in E. coli after x irradiation, 20: 42814

**PEDIGO, W. R.,** Fluidized bed recovery of F in manufacture of $UF_6$, 20: 43199

**PEELLE, R. W.,** Differential cross sections for production of protons in reactions of 160-Mev protons on complex nuclei, 20: 44649 (ORNL-3887)

**PEEVA, A.,** Dead time and fatigue in self-quenching G-M counters at different temperatures, 20: 43710

**PEISACH, Max,** Determination of C, N, and O and their stable isotopic tracers in gases, 20: 43115

**PEISHEL, F. L.,** Philosophy of chemical processing equipment design and installation in Transuranium Processing Plant, 20: 43425 (ORNL-P-240

**PEKHOV, A. P.,** Biological effect of space-flight factors using lysogenic bacteria, 20: 42911

**PEKHOV, A. P.,** Phage production of E. coli induced during flights of Vostok-3 and Vostok-4, 20: 42910

**PELETSKII, V. E.,** Thermal conductivity and degree of blackness of Nb at temperatures above 1000 C, 20: 43976

**PELLEGRINI, C.,** Transverse resistive-wall instability of extremely relativistic beams of electrons and positrons, 20: 44058

**PELLEGRINI, F.,** Shell-model states of the oxygen isotopes, 20: 44749

**PELLEGRINI, G.,** Modification of duration of physiologic activity of insulin subjected to labeling with $^{131}$I, 20: 42760

**PELLEGRINI, G.,** Modification of biologic activity of labeled insulin, 20: 42761

**PELOU, C.,** Sintering of $(U,Pu)O_2$ pellets, 20: 43865 (EURFNR-96F)

**PELTE, D.,** Low-lying J = ½ states in $^{21}$Ne and $^{23}$Na, 20: 44754

**PENDHARKAR, M. S.,** Separation of Nb from Ta by solvent extraction using TBP, 20: 43131

**PENFIELD, H.,** Radio astronomical detection of helium, 20: 44081

**PEN'KOVSKII, V. V.,** Chemical dosimetry of ionizing radiations, 20: 43293 (AD-633448)

**PENNA, R.,** Effect of x rays on proliferative activity of stem cells derived in culture from lymphocytes of human blood, 20: 42872

**PENNINGTON, E. M.,** Comparison of multilevel and single level effects for a fissionable isotope, 20: 44630 (CONF-660303, pp 997-1003)

**PENTZ, S.,** Dependence of somatic mutation spectrum of Ephestia kuehniella of irradiated animal, 20: 42970

**PERELOMOV, A. M.,** Certain peculiarities of Schrodinger equation solutions for potentials with Coulomb tails, 20: 44283 (NP-16280)

**PERELOMOV, A. M.,** Ionization of atoms in a varying electric field. II., 20: 44151

**PERFIL'EV, Yu. D.,** Liquid-phase radiation-induced carboxylation of hydrocarbons with $CO_2$, 20: 43333

**PERGAMENSHCHIK, B. K.,** Influence of neutron radiation on some properties of refractory concretes, 20: 44005

**PERICART, Jean,** Difficulties and hopes created by MHD for the large cell conversion of thermal energy into electrical energy, 20: 44175

**PERINOVA, M.,** Hardening of NaCl single crystals by x rays, 20: 45005

**PERKIN, J. L.,** Measurements and calculations of the Doppler effect on the reactions $^{238}$U(n,$\gamma$), $^{235}$U(n,f) and $^{239}$Pu(n,f) with neutrons in the energy range 0-25 kev, 20: 44627 (CONF-660303, pp 933-8)

**PERKINS, C. W.,** Prog. rpt. on radiation effects on microelectronic

circuits, 2–4/66, 20: 43753 (AD-636773)
**PERKINS, R. W.,** Trace elements and $^{137}$Cs in sea water by gamma-ray spectrometric techniques, 20: 43059 (BNWL-SA-674)
**PERKINS, W. A.,** E × B energy analyzer for electrons, 20: 44957
**PERLMAN, I.,** Semiconductor revolution in nuclear radiation counting, 20: 43737
**PERLOWAGORA-SZUMLEWICZ, Aline,** Procedures in studies on induced resistance against schistosomiasis in mice, 20: 42947
**PERRIN, R.,** Growth of interstitial clusters in graphite under irradiation, 20: 44021
**PERSIANI, P. J.,** Chemical binding effects on resonance line shapes of $^{238}$U in $UO_2$ lattice, 20: 45064 (CONF-660303, pp 134-45)
**PERULLI, Mariano,** Allowed bands for wave generation through nonlinear effects in a plasma, 20: 44893
**PERUZZI, I.,** A measurement of the branching ratio $\omega \rightarrow$ neutrals/$\omega \rightarrow \pi^+ + \pi^- + \pi^0$, 20: 44176 (LNF-66/31)
**PETERS, G. J.,** SCAT-1 program to compute $T_{ii}^{''}$ matrices on the Philco-2000, 20: 44663 (WAPD-TM-571)
**PETERSEN, Ronald O.,** Prog. rpt. on recrystallization and sintering of oxides, 9/65–8/66, 20: 43813 (COO-1122-3)
**PETERSON, Bruce A.,** Expected number of blue-shifts and red-shifts of ejected sources, 20: 44085
**PETERSON, D. T.,** Electrotransport of C, N, and O in Th, 20: 43820
**PETERSON, D. T.,** Lanthanum–La hydride phase system, 20: 43234
**PETERSON, G.,** Strontium-90 in beagle hair, 20: 42780
**PETERSON, P. J.,** Irradiation capsule for molten Pu alloys, 20: 43996 (LA-DC-7772)
**PETERSON, R. W.,** Research activities of the A.E.C. aircraft in atmospheric testing, 20: 44417 (LA-DC-7837)
**PETIAU, P.,** Decay of the $K^0$ meson into three pions, 20: 44228
**PETIT, Michelle,** Hyperproduction of diphtheria and tetanus antibodies following irradiation, 20: 42887
**PETROVA, L. A.,** Thermomechanical treatment of the $\beta$ alloy of the Ti–Mo–Cr–Fe–Al system, 20: 43961
**PETROVA, N. D.,** Radiation protection effects of DNA, RNA, RNA hydrolyzate and orotic acid on leukopoiesis in rabbits and rats, 20: 42937
**PETRU, F.,** Formation of scandium oxide chloride phases, 20: 43260
**PETRU, Frantisek,** Advances in scandium chemistry, 20: 43203
**PETTUS, W. G.,** Doppler coefficient measurements on Th and $ThO_2$ rods with nonuniform temperature distributions, 20: 45088
**PETUKHOV, B. V.,** Relation between the form-factor of a single particle matrix element of the energy-momentum tensor and the charge and magnetic moment, 20: 44391
**PETZOW, Guenter,** System $U–UMn_2–UAl_2–UFe_2$, 20: 43980
**PEVSNER, A.,** Search for a baryon of positive strangeness, 20: 44195
**PEZDIRTZ, George F.,** Cross-linking of polyvinylidene fluoride by gamma radiation, 20: 43371
**PEZDIRTZ, George F.,** Poly(imidazopyrrolones): a new class of radiation resistant polymers, 20: 43286
**PFLUEGER, W.,** Measurement and control devices of the loading installation (AVR), 20: 45140
**PFORDTE, Klaus,** Effects of uv radiation on the serum properdin level in vitro, 20: 42823
**PHAM TU MANH,** Paramagnetic amplification of a beam plasma system, 20: 44892
**PHILIPP, H.,** Bibliography on decontamination, 6/66, 20: 43569 (AED-C-13-04)
**PHILIPP, J.,** Radiometric determination of the $K_2O$ content by using a scintillation counter, 20: 43121
**PHILLIPS, Norman E.,** Calorimetric investigation of superconductivity in alpha uranium, 20: 44504 (UCRL-17026)
**PHILLIPS, Norman E.,** Heat capacity of $\alpha$ U at a pressure of 10 kbar, between 0.3 and 6°K, 20: 44557
**PHILLIPS, R. J. N.,** Resonance tails and high-energy $\pi N$ charge exchange, 20: 44201
**PHILLIPS, T. L.,** Influence of AET and hypoxia on recovery from radiation injury, 20: 42988
**PICASSO, E.,** Anomalous magnetic moment of the negative muon, 20: 44207
**PICHA, Engelbert,** Question of daily rhythmic variations in radiation sensitivity in tumor-bearing mice and control animals, 20: 43048
**PICHLMAIER, Heinz,** Present status of kidney transplantation in humans, 20: 43032
**PICKERING, R. J.,** Radioactivity in bottom sediments of the Clinch-Tennessee Rivers, 20: 45223
**PICONE, L. F.,** Chemical evaluation of Yankee Core I fuel cladding corrosion products, 20: 45126 (WCAP-6072)
**PIERCE, T. B.,** Use of tri-iso-octylamine as anion exchanger for partition chromatography, 20: 43439
**PIETSCHMANN, H.,** Difficulties of the static quark model in the case of the $\eta$-decays, 20: 44235
**PIGAL'SKAYA, L. A.,** Thermal properties of molybdenum at elevated temperatures, 20: 43977
**PIKAEV, A. K.,** EPR spectra of irradiated frozen aqueous solutions. II., 20: 43309
**PIKAEV, A. K.,** EPR spectra of irradiated frozen aqueous solutions. III., 20: 43310
**PIKE, E. Grant,** Fluidized bed deposition of an oxidation-resistant coating, 20: 43881
**PIKETTY, C. A.,** Quasi-elastic neutrino scattering on nuclei, 20: 44740
**PIKUS, G. E.,** Tunneling current in a transverse magnetic field, 20: 44572
**PINCHAS, S.,** Infrared absorption spectrum of $^{18}$O-labeled glycine, 20: 43283
**PINE, J.,** $\bar{p}p$ elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263
**PINKAU, Klaus,** Moliere's theory of multiple scattering applied to the spark chamber, 20: 43744
**PINTAR, M.,** Fluorine magnetic resonance shifts in paramagnetic $PuF_4$, 20: 43208
**PINTO, E. P.,** Radiostrontium in wet milk, tap-water, and rain water, 20: 42999 (NP-15934)
**PIRCHER, Felix J.,** Retention, distribution and absorption of inhaled particles, 20: 42797
**PISAPIA, M.,** Neoplasia of central lobe. Possibility of clinical, radiological, and endoscopic diagnosis, 20: 43037
**PISARENKO, N. F.,** Radiation protection during the flight in satellites "Voskhod I" and "Voskhod II", 20: 44990
**PIVARUNAS, Frank,** Group propagation in the Whistler-hydromagnetic extension of magnetoionic theory, 20: 44469
**PIVNIK, L. Ya.,** Preparation and properties of sodium zirconodisilicate $Na_2ZrSi_2O_7$, 20: 43220
**PIWONKA, Guillermo,** Influence of adrenal cortex on creatine excretion induced by irradiation in rat, 20: 42801
**PIZZI, J. R.,** Comparison of (d,t) and (d,$^3$He) cross sections, 20: 44794
**PLANEL, Hubert,** Biological activity of natural ionizing radiations, 20: 42886
**PLANTAMURA, V. L.,** Dynamic behavior of tunnel diode monostable circuits, 20: 43649
**PLATA BEDMAR, A.,** Utilization of radioactive isotopes in construction problems. II., 20: 43762
**PLATZ, H. R.,** Power plant cycles for dual-purpose plant applications, 20: 45188
**PLETNEV, V. D.,** Motion of charged particles in the vicinity of the neutral point, 20: 44460
**PLONKA, Andrzej,** Coefficients of tracer transfer through membranes. I., 20: 43239
**PLYUSHCHEV, V. E.,** Rare earth perrhenates, 20: 43217
**PNEUMAN, G. W.,** Rotation of the solar corona, 20: 44073
**PODERGIN, V. A.,** Intermetallic compounds of rare-earth metals with aluminium and some of their properties, 20: 43972
**PODYMAKHIN, V. N.,** Respiration of Salmo solar l. spawn in contaminated waters, 20: 42820
**POENARU, D. N.,** Nuclear radiation detectors based on semiconductor devices. IV., 20: 43739
**POIRIER, V. L.,** Prog. rpt. on vacuum foil-type insulation for radioisotope power systems, 5–7/66, 20: 43798 (ALO-3634-2)
**POKROVSKAYA, G. L.,** Effect of space-flight factors on herediatry structures of mammals, 20: 42986
**POKROVSKII, S. A.,** Problems of experimental and clinical radiobiology, 20: 42796
**POKROVSKII, V. L.,** Distribution function of distances between energy levels of an electron in a one-dimensional random chain, 20: 44130
**POLAK, L. S.,** Radiation-thermal cracking of low-octane number straight-run gasoline in uniform temperature field, 20: 43336
**POLEZHAEV, Yu. M.,** Preparation and properties of sodium zirconodisilicate $Na_2ZrSi_2O_7$, 20: 43220
**POLITOV, N. G.,** Influence of structural dislocations on mechanical properties of irradiated crystals, 20: 43304
**POLITOV, N. G.,** Local centers in irradiated ionic crystals, 20: 43306
**POLITOV, N. G.,** Radiation effects on dislocation densities in ionic crystals, 20: 43305
**POLKINGHORNE, J. C.,** Icecream-cone singularity in S-matrix theory, 20: 44306
**POLKINGHORNE, J. C.,** Normal thresholds in subenergy variables, 20: 44305
**POLLARD, J. P.,** Approach to the physics of thorium loaded beryllia moderated reactors, 20: 45176
**POLLYCOVE, Myron,** Classification and evolution of patterns of erythropoiesis in polycythemia vera, 20: 43015 (UCRL-16246, pp 1-18)
**POLOCKI, Boleslaw,** Reaction of rat intestines to parasympathomimetic substances during radiation syndrome, 20: 42984
**POLUEKTOV, I. A.,** The excitation of atoms by neutral particles, 20: 44146
**POLUEKTOV, N. S.,** Effect of chlorine on spectra of rare earth elements in flame, 20: 43152

**POLUEKTOV, N. S.,** Extraction of rare-earth antipyrine-salicylate complexes by benzene and fluorometric determination of Tb, 20: 43256

**POLUEKTOV, N. S.,** Fluorimetric determination of Y in rare earth elements after separation by paper chromatography, 20: 43150

**POLYAKOV, A. M.,** Spontaneous violation of strong interaction symmetry and the absence of zero-mass particles, 20: 44395

**POLYAKOV, Yu. I.,** Relation between the form-factor of a single particle matrix element of the energy-momentum tensor and the charge and magnetic moment, 20: 44391

**POMPEI, A.,** Reactions d(p,γ)$^3$He and d(n,γ)$^3$H, 20: 44748

**PONCELET, J.,** Increase of the temperature of flames by the addition of electrical energy, 20: 44926

**PONOMAREV-STEPNOI, N. N.,** Experimental studies of the influence of nonuniform fuel distribution on the heat rate in reactors, 20: 45208

**PONYATOVSKII, E. G.,** Apparatus for neutron diffractometry of specimens under high hydrostatic pressure, 20: 43473

**POOR, C. F.,** Data processing applications to a large, dual-purpose nuclear reactor, 20: 45191 (RL-GEN-1058)

**POORTMANS, F.,** Spin measurement of the 8.8 ev neutron resonance in $^{235}$U by means of the resonant scattering method, 20: 44619 (CONF-660303, pp 755-62)

**POPENOE, Peter,** Aeroradioactivity survey and areal geology of Denver area, Colorado (ARMS-I), 20: 43513 (CEX-59.4.26)

**POPLAWSKI, Bartholomew,** Bibliography on nuclear safety, 20: 43666 (AD-623557)

**POPOV, A. S.,** Effects of external α-irradiation on intensity of growth of cells in vitro, 20: 42943

**POPOV, N. I.,** Basic features of the global $^{90}$Sr distribution on surface of world's oceans (1960–1961), 20: 43516 (AEC-tr-6798, Paper 1)

**POPOV, N. I.,** Diffusion of soluble contaminants in the ocean, 20: 43541

**POPOV, N. I.,** Evaluation of total quantity of $^{90}$Sr in World Ocean, 20: 43517 (AEC-tr-6798, Paper 2)

**POPOV, V. G.,** Device for developing fast atomic and molecular beams, 20: 44145

**POPOV, V. I.,** Elastic scattering of neutrons, 20: 44669 (INDSWG-101, pp 109-57)

**POPOV, V. S.,** Certain peculiarities of Schrodinger equation solutions for potentials with Coulomb tails, 20: 44283 (NP-16280)

**POPOV, V. S.,** Ionization of atoms in a varying electric field. II., 20: 44151

**POPOV, Yu. P.,** Reactions by emission of charged particles caused by slow neutrons, 20: 44666 (INDSWG-101, pp 1-22)

**POPOVA, A. M.,** Differential crossing of inelastic interaction of nucleon with deuteron, 20: 44275

**POPOVICI, C.,** Beam-plasma instability in the hollow cathode discharge, 20: 44937

**POPRYADUHKIN, A.,** Topology of magnetic field and diffusion of plasma in toroidal traps, 20: 44875 (MATT-Trans-37)

**POPRYADUKHIN, A. P.,** Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)

**PORKOLAB, M.,** Plasma drift instabilities with phase velocities below the ion thermal velocity, 20: 44934

**POROK, J.,** Fluorine magnetic resonance shifts in paramagnetic $PuF_4$, 20: 43208

**PORTER, Bernard,** Density and molar volumes of binary fluroide mixtures, 20: 43165 (BM-RI-6836)

**PORTER, D.,** Photomultiplier resolving time measurements utilizing a light pulse generator, 20: 43709

**PORTER, David,** Decomposition of chromium–tungsten solid solution, 20: 43914 (UCRL-16619)

**POTEAT, L. E.,** Creep of polycrystalline thorium dioxide, 20: 43941

**POTTIER, Raymond,** Contribution of the α-γ and β-γ coincidences using device to analysis of Pu–Am, Np–Pu, Ru, Rh, Zr, and Nb mixtures, 20: 43158

**POTTS, J. E.,** Effect of radiation on ethylene-alkyl acrylate copolymers, 20: 43376

**POTTS, J. F.,** Plasma-density measurement in a hollow-cathode arc by arc reversal, 20: 44864 (ORNL-4010)

**POUCHON, M. A.,** Test of C invariance in the three pion decay of the η meson, 20: 44230

**POULET, M.,** Measurement of the parameters D and R′ in proton-deuteron triple elastic scattering, 20: 44233

**POUND, G. M.,** Homogeneous nucleation and growth of droplets in vapors, 20: 43674

**POWER, H. E.,** Gamma irradiation as means of extending storage life of haddock fillets, 20: 43770

**PRAGER, R.,** Dismountable pulse tube for nanosecond technique, 20: 43644

**PRAKASH, Satya,** Isomeric cross-section ratios in the (n,γ) reactions on $^{70}$Ge and $^{82}$Se, 20: 44816

**PRANE, L. Yu.,** Changes in blood Fe content and erythropoiesis indexes under influence of radiation, 20: 42908

**PRASAD, N. S. K.,** Preferential extraction of Ta from fluoride solutions in tributyl phosphate–sulfuric acid system, 20: 43437

**PRASLICKA, Milan,** Chromosome aberrations: increased incidence in bone marrow of irradiated rats, 20: 42951

**PRAVDINA, G. M.,** Seasonal variations of radiation sensitivity of rabbits, 20: 42848 (NP-16256)

**PREEDOM, B. M.,** Distorted wave predictions of observed J dependence in the (d,$^3$He) reaction, 20: 44800

**PREIHAELTER, J.,** Quasilinear theory of two-stream cyclotron instability of electron beams, 20: 44894

**PREISS, K.,** Comparison of theory and experiment for shielding by structure against fallout, 20: 43568 (AD-636787)

**PREKEL, H. L.,** Direct observation of etch pits at dislocations in molybdenum, 20: 43966

**PRENTICE, J. D.,** Properties of the 3.16-Mev level of $^{35}$Cl, 20: 44808

**PRESNYAKOV, L. P.,** Electron impact ionization cross sections of ions, 20: 44871 (CONF-660332-1)

**PRESTON, M. K.,** Remotely operated equipment for fabricating HFIR target elements, 20: 45204 (ORNL-P-2410)

**PRESTWICH, W. V.,** Level structure of $^{104}$Rh observed in thermal neutron capture, 20: 44690

**PRESTWICH, W. V.,** Reaction $^{59}$Co(n,γ)$^{60}$Co, 20: 44729

**PRIBNOW, J. F.,** Effect of macrophages from irradiated donors on ability to transfer antibody formation, 20: 42830 (AD-635598)

**PRICE, A. M.,** Mechanism of dimensional changes in crystals of graphites and carbons under fast neutron irradiation, 20: 44020

**PRICE, R. J.,** Neutron-induced changes in crystallinity and thermal conductivity of pyrolytic carbons, 20: 44009

**PRICE, R. J.,** Structure and properties of pyrolytic carbons prepared in a fluidized bed between 1900 and 2400°C, 20: 43930

**PRICEMAN, S.,** Niobium coating development for oxidation protection, 20: 43827 (GTR-19)

**PRICEMAN, S.,** Tin–aluminum coatings for the elevated temperature oxidation protection of columbium and columbium-base alloys, 20: 43836 (TID-17070)

**PRIDANTSEVA, K. S.,** Thermal expansion of the solid solutions of refractory metals of the IV, V, and VI groups of the periodic system, 20: 43964

**PRIGOGINE, I.,** Statistical mechanics of gravitational plasmas, 20: 44948

**PRIVEZENTSEV, V. I.,** Microwave refraction by a nonhomogeneous cylindrical plasma, 20: 44981

**PRIVEZENTSEV, V. I.,** Studying a plasma by probing with microwaves, 20: 44983

**PROCTOR, W. G.,** Temperature variation of $^{139}$La nuclear quadrupole resonance in $LaF_3$, 20: 45026

**PROFIO, A. E.,** Adequacy of fast and intermediate cross section data from measurement of neutron spectra in bulk media, 20: 44580 (CONF-660303, pp 782-95)

**PROKOSHKIN, D. A.,** Investigation of some properties of niobium alloys, 20: 43940

**PROSENZ, K.,** Pasteurization of fruit juices by irradiation, 20: 43787

**PROSPERI, D.,** Wave functions of spherical odd-mass nuclei, 20: 44742

**PROSPERI, G. M.,** Nonrelativistic nucleon-nucleon potential from S-matrix theory. II., 20: 44209

**PROSZT, G.,** Radiosensitivity of purified and crude pectic enzyme preparations, 20: 43785

**PROTOPOPOV, V. N.,** Fast neutron spectrometer using Si surface-barrier detectors and Li$^6$F, 20: 43718

**PROUT, William E.,** Dissolution of thorium oxide, 20: 43412 (DP-1044)

**PRUGOVECKI, E.,** Gauge-invariant model of quantum electrodynamics without spinor fields, 20: 44340

**PRUZZI, Maria Carla,** Serum lysozyme in animals subjected to whole-body x irradiation, 20: 42944

**PRYAKHINA, L. I.,** Ternary chemical compounds Ni–Ti–Nb system, 20: 43971

**PRYOR, A. W.,** Analytical description of growth of beryllium oxide during neutron irradiation, 20: 43985 (AAEC-TM-318)

**PRZYBORSKI, Wincenty,** Semiconductor system for charged particles identification, 20: 43717

**PSTROKONSKI, M.,** Generation of the high-energy nucleon-electron cascade by means of the program written for the small computer, 20: 44152

**PSTROKONSKI, M.,** Program for the interpolation of the cascade curves with the aid of a small electronic computer, 20: 44153

**PUGACHEVSKII, V. P.,** Radiobiological parameters of accumulation and elimination of radioactive phosphorus by inhalation, 20: 42783

**PUGH, G. W. Jr.,** Ultraviolet radiation and Moraxella bovis in etiology of bovine infectious keratoconjunctivitis, 20: 42863

**PULLEN, D. J.,** Analog states in $^{55,57}$Co and $^{59,61}$Cu excited by ($^3$He,d) reactions, 20: 44837

**PURANDARE, H. D.,** Physics studies of prototype power reactor project, 20: 45104 (AEET-239)

**PURCELL, C. L.,** Effect of radiation on ethylene-alkyl acrylate copolymers, 20: 43376

**PURCELL, W. L.,** Sensitivity of thermal reactor parameters to scattering model, 20: 45065 (CONF-660303, pp 146-50)
**PURKAYASTHA, B. C.,** Tetrahydrated double sulfates of tervalent elements with radioactive indicators, 20: 43252
**PURKAYASTHA, B. C.,** Uptake of $^{89}$Sr and $^{90}$Sr by $CaSO_4$ and its role in morphological and geochemical studies, 20: 43534
**PURKAYASTHA, B. C.,** Use of bismuth iodatein separation of tetravalent actinides, 20: 43448
**PUROHIT, S. N.,** Neutron scattering and thermalization lectures, 20: 44587 (NP-16291)
**PUSCH, W. M.,** Estimation of internal contaminations with U from urine excretion rates, 20: 43000
**PUSTOVALOV, V. V.,** Complete angular function set in the three-body problem for an arbitrary orbital momentum, 20: 44500
**PUT, L. W.,** Associated particle method for the D(d,n)$^3$He reaction, 20: 44813
**PUTNEY, Zimri,** Angular dependence of mutual friction in rotating He II, 20: 44539
**PYT'EV, Yu. P.,** Spinor field, 20: 44388
**PYZHOVA, Z. I.,** Express method for separating ionium ($^{230}$Th) from sulfuric acid uranium solutions, 20: 43147

# Q

**QUAECK, J.,** Studies of U and U–Zr alloys including behavior with temperature changes and formation of structures, 20: 43983
**QUARRINGTON, J. A.,** Improved sheathed electric heater, 20: 43465 (AECL-2592)
**QUATINETZ, Max,** Structure and properties of tungsten-base powder metallurgy composites, 20: 43899 (NASA-TN-D-3610)
**QUENEE, Robert,** Method of biological and medical exploration: ionography calibrated in roentgens, 20: 43028
**QUINN, J. J.,** Acoustic nuclear spin resonance in metals, 20: 45023
**QUINTON, A. R.,** Energy loss and straggling of alpha particles in metal foils, 20: 44144
**QUIRK, E. J. M.,** Monitor for low-level $\beta$ radioactivity in reactor cooling water, 20: 43688

# R

**RAAB, G. J.,** Remote maintenance in a large scale separations plant, 20: 43417 (ISO-SA-25)
**RABAN, Morton,** Determination of optical purity by nuclear magnetic resonance spectroscopy. II., 20: 43254
**RABAN, P.,** Preparation of rose bengal–$^{131}$I and the testing of its purity, 20: 43386
**RABBETT, William F.,** Juvenile laryngeal papillomatosis, 20: 43023
**RABIDEAU, S. W.,** Nuclear magnetic relaxation measurements of $^{17}$O in enriched $H_2{}^{17}O$ and $D_2{}^{17}O$, 20: 43171 (LA-DC-7394(Rev.))
**RABINOVICH, M. S.,** Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)
**RACHINGER, W. A.,** Removal of superconducting surface-sheath by copper-plating, 20: 44530
**RACOVEANU, N.,** Study of $^{65}$Zn distribution in protein fractions of guinea-pig serum, 20: 42791
**RADICELLA, R.,** Albumin macroaggregates labeled with $^{99m}$Tc, 20: 43390
**RADKEVICH, I. A.,** Spark chambers for recording slow particles, 20: 43724
**RADOJEVIC, Vojislav,** Calculation of rotation gamma-vibration interaction in transuranic nuclei, 20: 44694
**RADZIKOVSKAYA, S. V.,** Sulfides of rare earth metals and actinides, 20: 43264
**RAEDESCU, E.,** Anisotropy of the Debye-Waller factor for the Moessbauer effect in thin films, 20: 44137
**RAFAL'SON, A. E.,** High-sensitivity radio-frequency mass spectrometer for investigating ionic and neutral composition of upper atmosphere, 20: 43648
**RAGLAND, James B.,** Combustion of samples for liquid scintillation counting, 20: 43128
**RAINWATER, James,** Capabilities and limitations of time-of-flight neutron spectroscopy between 100 ev and 100 kev, 20: 44610 (CONF-660303, pp 381-403)
**RAIZER, Yu. P.,** Evaluation of the coefficient of dissociative recombination in the lower ionosphere, 20: 44464
**RAJAGOPALAN, M.,** Preparation of thin uniform targets of actinide elements, 20: 43396
**RAJAGOPALAN, R.,** Preparation of $^{204}$Tl sources from irradiated Tl metal, 20: 43400
**RAJAMA, J.,** Strontium-90 in Finnish and some imported cereals during the harvest period 1963–64, 20: 43006
**RAJAN, M. V.,** Separation and estimation of $^{228}$Ra in Th plant effluent, 20: 43442
**RAJBENBACH, L. A.,** Nondissociative electron attachment reactions in $\gamma$ radiolysis of solutions of cyclic perfluorocarbons in alkanes, 20: 43316
**RAJU, Mudundi R.,** Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)
**RAKAVY, G.,** Use of integral measurements as supplementary data for determining neutron cross-sections, 20: 44577 (CONF-660303, pp 304-8)
**RAKHIMBAEV, B. G.,** Inelastic p-p interactions at 2.26 Bev, 20: 44189
**RAKHIMOVA, M.,** Effects of ionizing radiation on content of fat and starch in cotton plant pollen, 20: 42896
**RAKOTONDRAFARA, Henri,** Measurement of integral flux of fast neutrons by Geiger-Mueller counters with activable cathodes, 20: 43729
**RALLS, K. M.,** Internal surface superconductivity, the relationship between resistive critical field and bulk upper critical field, 20: 44534
**RAMACHANDRAN, G.,** Pion scattering on nuclei, 20: 44719
**RAMADURAI, S.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458
**RAMAKRISHNAN, Alladi,** Scattering phase shift in stochastic fields, 20: 44393
**RAMANAN, G.,** Radiation induced reactions involving cyclohexane and cyclohexene, 20: 43361
**RAMANATHAN, G. V.,** New cluster scheme in statistical physics, 20: 44915
**RAMANI, M. P. S.,** Apparatus for thermal conductivity determination of organic coolants used in nuclear reactors, 20: 43270 (AEET-245)
**RAMANIAH, M. V.,** Isomeric cross-section ratios in the $(n,\gamma)$ reactions on $^{76}$Ge and $^{82}$Se, 20: 44816
**RAMANIAH, M. V.,** Mass yields of $^{99}$Mo, $^{105}$Rh, and $^{132}$Te in the spontaneous fission of $^{238}$U, 20: 44815
**RAMANIAH, M. V.,** Preparation of thin uniform targets of actinide elements, 20: 43396
**RAMAPRASAD, K. R.,** Possible separation of U from Th in mixtures of $UO_2$–$ThO_2$ by chlorination, 20: 43443
**RAMOS, A. Tiemblo,** On the $\eta \to \pi^0\gamma\gamma$ decay mode, 20: 44205
**RAMOS, E.,** Radioprotective properties of 1-phenyl-4,5-(D-glucopyranyl)-imidazoline-2-thione and 1-p-ethoxyphenyl-4-D-arabinyltetrahydroxybutylimidazoline-2-thione, 20: 42979
**RAMSAK, V.,** Spectrometer for 14 Mev neutron capture spectroscopy, 20: 43708
**RAMSEY, D. C.,** Solving systems of polynomials in several indeterminates, 20: 43806 (ORNL-4008)
**RANDAZZO, Donald J.,** Magnetic studies on erbium and terbium in gadolinium trichloride, 20: 43177 (NP-16303)
**RANE, A. T.,** Nuclear spectroscopic studies of $^{101}$Mo → $^{101}$Tc → $^{101}$Ru decay chain using chemically separated activities, 20: 44817
**RANE, A. T.,** Rapid radiochemical separations of $^{90}$Sr–$^{90}$Y and $^{45}$Ca–$^{46}$Sc on cation exchange resin, 20: 43430
**RANGANATHAN, T. N.,** Preferential extraction of Ta from fluoride solutions in tributyl phosphate–sulfuric acid system, 20: 43437
**RAO, B. V. Narasimha,** Lifetimes of 158 and 208 kev. Levels of $^{199}$Hg, 20: 44704
**RAO, C. L.,** Isomeric cross-section ratios in the $(n,\gamma)$ reactions on $^{76}$Ge and $^{82}$Se, 20: 44816
**RAO, C. L.,** Mass yields of $^{99}$Mo, $^{105}$Rh, and $^{132}$Te in the spontaneous fission of $^{238}$U, 20: 44815
**RAO, C. L.,** Study of Pu(III)–sulfate complexes, 20: 43244
**RAO, G. Gopala,** Titrimetric determination of V(IV) with Ce(IV) sulphate at room temperature using ferroin as indicator, 20: 43144
**RAO, G. S.,** Extraction of metallic cations by di-acidic phosphorus-based extractants in metone diluent, 20: 43445
**RAO, K. Narayana,** Radiation induced reactions involving cyclohexane and cyclohexene, 20: 43361
**RAO, K. R.,** Neutron scattering from gaseous methane and ammonia, 20: 44599
**RAO, K. V. S. Rama,** Radiolysis of aqueous solutions, 20: 43357
**RAO, M. R.,** Gamma radiolysis of the isomers of ethyl toluene, 20: 43359
**RAPOPORT, I. D.,** Telemetering of pulses from scintillating cosmic ray detector over wide dynamic range, 20: 43687
**RASHAD, A. R. M.,** MHD species separation in a gaseous nuclear rocket using a time varying traveling wave electromagnetic field, 20: 45201
**RASTOGI, B. P.,** Fuel cycles in PHWR and CANDU type reactors, 20: 45105 (AEET-252)
**RASTOGI, B. P.,** Physics studies of prototype power reactor project, 20: 45104 (AEET-239)
**RATHER, Tatjana Grigorjevna,** Phantom for determining radiation doses, 20: 43053
**RATHVON, H. C.,** Recovery of $^{233}$U from irradiated thoria, 20: 43415 (ISO-SA-3(Rev.))
**RAU, F.,** Stored energy, volume, and resistivity change in neutron-irradiated Al, 20: 45037
**RAUSCH, W.,** Experiments with installation parts (AVR), 20: 45146
**RAWSON, Donald E.,** Industrial applications of contained nuclear explosions, 20: 43463 (UCRL-14756)
**RAY, H. N.,** Gravimetric method for cobalt, 20: 43145

**RAY, J. H.,** Neutron cross sections of N, O, Al, Si, Fe, D, and Be, 20: 44661 (UNC-5139)

**RAY, M. N.,** Thermal decomposition of irradiated thorium oxalate, 20: 43363

**RAYNOR, Gilbert S.,** Twenty-four-hour dispersion of ragweed pollen from known sources, 20: 45235 (BNL-957)

**RAZGOVOROV, B. L.,** Radiation protection by mercaptoalkylamines and indolylalkylamines against $\gamma$ rays and proton beams, 20: 43002

**RAZUMOVA, K. A.,** Thermal insulation ot plasma in Tokamak, 20: 44873 (MATT-Trans-35)

**RAZUMOVSKAYA, A. I.,** Photomultiplier sensitive in ultraviolet spectral region, 20: 43727

**READ, J. F.,** Effect of alpha and gamma radiation on an enzyme, 20: 42816

**REDDEN, T. K.,** Fabrication of a columbium alloy liquid metal loop, 20: 43879

**REDDY, A. S.,** Solvent extraction of Th from hydrochloric acid solutions, 20: 43444

**REDDY, G. R.,** Determination of Rb and Cs by neutron activation, 20: 43133

**REDMAN, W. C.,** Low flux determination of capture-to-fission ratio, 20: 45071 (CONF-660303, pp 1092-7)

**REED, George W. Jr.,** Halogens in chondrites, 20: 44077

**REED, Jack W.,** Multiple row charge blast-wave observations, Project DUGOUT, 20: 43461 (PNE-607F)

**REED, S. A.,** Corrosion of carbon and alloy steels in water and seawater, 20: 43834 (ORNL-TM-1612)

**REES, D. B.,** Electron density maximization in a Penning gas mixture ionized by fission fragments, 20: 44933

**REES, M. J.,** Appearance of relativistically expanding radio sources, 20: 44083

**REEVES, Andrew L.,** Experimental Be toxicology, 20: 42754

**REEVES, Robert J.,** Retention, distribution and absorption of inhaled particles, 20: 42797

**REICHERT, L.,** Energies of neutral sputtered particles, 20: 44139

**REIMANN, Rudolph,** Absorption, fluorescence, and bleaching of pure and activated Cd fluoride crystals, 20: 45006

**REISS, F.,** Emissivity and electrical resistivity of flame-sprayed $Al_2O_3$ and $ZrO_2$ coatings at higher temperatures, 20: 43927

**REMIDDI, E.,** New family of sum rules from current algebra, 20: 44362

**RENKER, Karl,** Recording pulse density and time rate of broad detector signals, 20: 43643

**RENNARD, R. J. Jr.,** Hydrogen–deuterium equilibration over Pd hydride, 20: 43232

**RENUCCI, Louis,** Surface aspect presented by Zr annealed in the $\beta$ phase, 20: 43933

**REPALOV, N. S.,** Injection of particles into a mirror trap through magnetic cusp configuration, 20: 44971

**RESNICK, Michael I.,** Effects of irradiation on lymphatic dynamics, 20: 42976

**REUSS, Albrecht,** Dose distribution by use of different filter elements in cones, 20: 43047

**REYNOLDS, C. A.,** Superconducting properties and anisotropic electrical resistivities of pure and cadmium-doped tin, 20: 44546

**REYNOLDS, G. M.,** Three L = 0 transitions in the $^{57}Fe(p,t)^{55}Fe$ reaction, 20: 44756

**REZNIK, B.,** Niobium coating development for oxidation protection, 20: 43827 (GTR-19)

**REZNIK, G. S.,** Precision of radon estimation in human body, 20: 43604

**RHODES, D. N.,** Radiation preservation of fish in developing countries, 20: 43775

**RHODES, D. N.,** Radiation induced changes in polyamino acids, 20: 42826

**RIAZUDDIN,** Algebra of currents and the $K_1^0$-$K_2^0$ mass difference, 20: 44266

**RIAZUDDIN,** $SU_6$ algebra of Gell-Mann and four-pion coupling constant, 20: 44336

**RICCA, F.,** Isotopic mixing in hydrogen chemisorbed on polycrystalline tungsten, 20: 43255

**RICCARDI, A.,** Response to radiotriolein test in adults and aged persons, 20: 42782

**RICHARDS, J. R.,** Lead isotopes and volcanic magmas, 20: 43521

**RICHARDS, P. L.,** Far-infrared response of point-contact Josephson junctions, 20: 44548

**RICHARDSON, J. R.,** Use of the 3/2-radial resonance in extraction from a six-sector isochronous cyclotron, 20: 44054

**RICHARDSON, Robert D.,** Process gas chromatograph for reactor blanketing gas, 20: 43157

**RICHMAN, Chaim,** Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)

**RICHMOND, C. R.,** Movement of discrete particles through gastrointestinal tract, 20: 42740 (LA-DC-7764)

**RICHTER, A.,** Test of time-reversal invariance in the reactions $^{24}Mg(\alpha,p)^{27}Al$ and $^{27}Al(,\alpha)^{24}Mg$, 20: 44793

**RICKARD, W. H.,** Cesium-137 in Bromus tectorum L. in relation to precipitation regimes and harvest yields, 20: 43527

**RIDAL, A.,** Fabrication of $^{233}U$/Al fuel plates for sub-critical assembly, 20: 43844 (AAEC-TM-315)

**RIDLEY, R. G.,** Fast counting with the scintillation detector, 20: 43746

**RIEGLER, Guenter,** Extended source of energetic cosmic x rays, 20: 44095

**RIEHL, N.,** International symposium on luminescence. Physics and chemistry of scintillators, Munich, 9/65, 20: 45044

**RIEUTORD, Emile,** Curvature of the shock wave in a shock tube, 20: 44890

**RIGAS, Demetrios A.,** Prog. rpt. on genetic alterations in human cells, 8/65–7/66, 20: 42707 (RLO-581-10)

**RIGDON, Lester P.,** Determination of impurities in B by x-ray fluorescence, 20: 43091 (UCRL-14879)

**RILEY, J. D.,** Sign of interactions between $Nd^{+3}$ ions in $LaCl_3$, 20: 45027

**RILEY, Ralph,** Differential sensitivity of desynaptic and normal genotypes of barley to x-rays, 20: 42923

**RIMONDI, C.,** Comparison between radiologic pictures and volumetric ventilatory data in pulmonary scleroses secondary to radiotherapy of bronchogenic neoplasm, 20: 43030

**RIPAN, Raluca,** New class of heteropoly compounds of octatungstocerates(IV). II., 20: 43253

**RISHBETH, H.,** F2-layer rates at sunspot minimum, 20: 44433

**RISTIC, Momcilo M.,** Thermodynamic characteristics of self-diffusion in $\alpha$-uranium, 20: 43928

**RITCHIE, R. H.,** Ladder corrections to the static random-phase-approximation dielectric constant and to positron annihilation in metals, 20: 44247

**RITTENBERG, V.,** Renormalizable field-theoretical model for weak interactions, 20: 44333

**RIVERS, R. J.,** Quark model derivation of meson-baryon coupling constant relations, 20: 44221

**RIVIERE, M. R.,** Development of pulmonary adenomas in mice after treatment of urethane associated with x rays, 20: 42891

**RIVIERE, M. R.,** Histogenesis of thymic lymphomas induced by whole body x irradiation in mice, 20: 42892

**ROBBINS, G. V.,** Radius generation in vibratory deburring, 20: 43847 (BDX-613-85)

**ROBERT, A.,** Silicon diodes used in neutron diffraction, 20: 43730

**ROBERTS, D. E.,** Stark widths of singly ionized argon lines emitted by a plasma, 20: 44931

**ROBERTS, F. P.,** Ion-exchange separation of kilocurie quantities of high purity Pm, 20: 43411 (BNWL-SA-677)

**ROBERTS, T. A.,** Radiation preservation of fish in developing countries, 20: 43775

**ROBERTS, W. T.,** Ionospheric rarefaction following rocket transit, 20: 44459

**ROBERTSON, D. E.,** Reduction of reactor effluent water radionuclides by addition of sodium silicate to process water, 20: 45215 (BNWL-282)

**ROBERTSON, D. E.,** Trace elements and $^{137}Cs$ in sea water by gamma-ray spectrometric techniques, 20: 43059 (BNWL-SA-674)

**ROBERTSON, Roy C.,** Design studies of 1000-Mw(e) molten-salt breeder reactors, 20: 45116 (ORNL-3996)

**ROBERTSON, W. J.,** Laboratory investigation of recovery processes for pitchblende residues, 20: 43420 (MCW-1508)

**ROBERTSON, W. J.,** Production of thorium oxide for vibratory compaction by a modified sol-gel process, 20: 43850 (CONF-660524-15)

**ROBINSON, C. V.,** Bone marrow stem cell survival in nonuniformly exposed mammal, 20: 42844 (BNL-10385)

**ROBISON, William Lewis,** Ion binding properties of human serum lipproproteins, 20: 42743 (UCRL-14631)

**ROBSON, J.,** Recovery of uranium from Zircaloy–uranium alloy, 20: 43438

**ROCHE, Jean,** Electrostatic collection of Th A, 20: 43387

**RODABAUGH, E. C.,** Flexibility of nozzles in spherical shells, 20: 43468 (TID-23344)

**RODABAUGH, E. C.,** Stresses at nozzles in spherical shells loaded with pressure, moment or thrust, 20: 43467 (TID-23343)

**RODARI, T.,** Modification of duration of physiologic activity of insulin subjected to labeling with $^{131}I$, 20: 42760

**RODARI, T.,** Modification of biologic activity of labeled insulin, 20: 42761

**RODDY, J. W.,** Mass action and non-ideality in extraction by amine sulfate, 20: 43423 (ORNL-P-2354)

**ROEDEL, W.,** Isotopes $^{22}Na$ and $^{24}Na$ in the atmosphere, 20: 43546

**ROEDER, John Louis,** Coupled channels and their application to resonances in the scattering of low-energy neutrons by $^{12}C$, 20: 44653 (PUC-937-219)

**ROEDERER, Juan G.,** Computational model for geomagnetically trapped particle shells and kinematic parameters, 20: 44416 (AD-639436)

**ROEPER, Peter,** Single-particle levels in a deformed energy-dependent nuclear potential, 20: 44830

**ROERBO, K.,** Compatibility of SAP 930 with $UO_2$ and UC, 20: 43835

(RISO-91)

**ROESCH, W. C.,** Radiation dosimetry for radiation protection, 20: 43572 (BNWL-SA-816)

**ROETHIG, Douglas T.,** Resolution of x-ray sources at low galactic longitude, 20: 44091

**ROGACHEV, V. I.,** Use of ionizing radiations to prolong storage life of fruit and berries, 20: 43782

**ROGERS, A. W.,** Evaluation of quench correction in liquid scintillation counting, 20: 43675

**ROGERS, E. C.,** Nature of the 50 c/s phase transition in type II superconductors, 20: 44522

**ROHATGI, Vijay K.,** Negative bias probe for high-density plasma study, 20: 44909

**ROHE, L. B.,** Commitment of the AVR to the construction of the reactor, 20: 45131

**ROHR, W. G.,** Liquid Pu: a review of its unusual properties, 20: 43889 (CONF-660606-39)

**ROHRLICH, F.,** Ordering theorems, 20: 44311

**ROHRLICH, F.,** Role of causality in quantum field theory and the dynamical postulate, 20: 44317

**ROHRLICH, F.,** True and apparent transformations, classical electrons, and relativistic thermodynamics, 20: 44036

**ROHWER, Paul S.,** Radiation effects upon gastrointestinal absorption of water in rat, 20: 42971

**ROJO, Enrique A.,** Reaction of isopropylbenzene on $\gamma$-irradiated silica gels, 20: 43319

**ROKACH, Joshua,** Electron and $\gamma$-ray induced addition of formamide to olefins, 20: 43347

**ROLLNIK, H.,** Reggeized vector meson exchange for neutral pion-photoproduction, 20: 44240

**ROMAN, P.,** Intrinsic mass-splitting in a de Sitter world, 20: 44338

**ROMANOV, A. A.,** Adsorption capacity of zeolites, 20: 43499

**ROMPE, R.,** Cross sections of elementary processes, reaction kinetic considerations, inversion of term position numbers in weakly ionized plasmas, 20: 44928

**RON, M.,** Moessbauer spectrometer calibration using $^{57}$Fe enriched metallic iron, 20: 43707

**RONCORONI, L.,** Investigation of radiosensitizer by measurement of uptake of $^{32}$P in irradiated tumors, 20: 42776

**RONGVED, L.,** Mechanics in Euclidian terms giving all the three Einstein effects, 20: 44489

**RONSIN, G.,** Production and study of the isomers $^{179m}$Hf and $^{177m}$Yb, 20: 44709

**RONSIVALLI, L. J.,** Quality and wholesomeness of radiation-pasteurized marine products, 20: 43768

**ROOK, L. W.,** Motivation and human error, 20: 45241 (SC-TM-65-135)

**ROOT, K. D. J.,** General correlation of E.S.R. data for F-centers, 20: 43350

**ROSE, H. J.,** Comparison of signs of mixing ratios to model predictions, 20: 44784

**ROSE, H. J.,** The $5/2^- \rightarrow 1/2^-$ mirror transitions in mass 15, 20: 44783

**ROSE, Roar,** Experience from the experimental operation of the Halden Heavy Water Boiling Reactor (HBWR), 20: 45164

**ROSESCU, Th.,** Matrix calculations in nuclear reactor physics, 20: 45058

**ROSHCHINA, L. I.,** Radiation-induced colors in deformed alkali-halide crystals, 20: 45041

**ROSHCHUPKIN, D. I.,** Effect of gases on thermoluminescence of frozen proteins and aromatic amino acids irradiated with ultraviolet light, 20: 42804

**ROSNER, B.,** Analog states in $^{55,57}$Co and $^{59,61}$Cu excited by ($^{3}$He,d) reactions, 20: 44837

**ROSNER, Baruch,** Study of (d,p) and (d,t) reaction on the $^{136}$Xe isotope, 20: 44842

**ROSNER, J.,** Absorptive parts and the Bethe-Salpeter equation for forward scattering, 20: 44310

**ROSS, John D.,** Compact actuator system for reactor control, 20: 45190 (DP-670)

**ROSS, Richard,** Precipitation of uranium dioxide from alkali chloride melts, 20: 43185 (ZFK-WF-25)

**ROSSOUW, S. F.,** Bibliography on nuclear techniques in forensic science, 20: 43082 (PEL-116)

**ROTBARD, G.,** Production and study of the isomers $^{179m}$Hf and $^{177m}$Yb, 20: 44709

**ROTH, J. A.,** Radiolytic peroxidation of p-xylene, 20: 43369

**ROTH, Jerome A.,** Mechanism of metal-catalyzed hydrogenation and exchange. Phenyl effect, 20: 43279

**ROTH, Lothar,** Capillary arc source for production of Hg$^{+}$ ions, 20: 44119

**ROTH, R. S.,** Phase equilibria and crystal structure in $Nb_2O_5$–$WO_3$, 20: 45012

**ROTHSTEIN, Aser,** Prog. rpt., annual, 1965, 20: 42718 (UR-49-687)

**ROTSEY, W. B.,** Behavior of beryllium oxide-based dispersion fuels, 20: 44014

**ROULT, G.,** Silicon diodes used in neutron diffraction, 20: 43730

**ROUSE, Irving,** Radiocarbon. 8., 20: 43560

**ROUSEL, P.,** Quadrupole and octupole excitations of spherical even-even nuclei in the region of closed shells, 20: 44799

**ROUSH, Larry L.,** Determination of trace elements in W and Mo by atomic absorption spectrophotometry, 20: 43154

**ROUSSEL, P.,** Second-order excitation in the inelastic scattering of $\alpha$ particles, 20: 44795

**ROUX, D. P.,** Optimization of reactor shutdown margin measurements in high gamma fluxes, 20: 45048 (ORNL-P-2311)

**ROVINSKII, R. E.,** A steady-state induced discharge, 20: 44961

**ROWAN, J. H.,** Falling drop density analysis for relative concentrations of H and D in lithium deuteride, 20: 43089 (Y-1175(Del.))

**ROWE, M. W.,** Mass yield spectrum of cosmic-ray-produced xenon, 20: 44079

**ROWE, R. M.,** Refinements in precision kilovolt pulse measurements, 20: 43634 (SLAC-PUB-199)

**ROWLANDS, R. P.,** Physiologically safe working conditions for men wearing pressure suits, 20: 43571 (AHSB(RP)-R-70)

**ROZENTAL', I. L.,** Subcosmic electrons, 20: 44156

**RUBIN, Leonard R.,** Permeation of deuterium and hydrogen through palladium and 75 palladium-25 silver at elevated temperatures and pressures, 20: 43935

**RUDALI, G.,** AKR leukemogenesis after x irradiation followed by restoration by allogenic fetal liver, 20: 42893

**RUDASHEVSKII, E. G.,** Interaction between electromagnetic, plasma, and spin waves in antiferromagnetic semiconductors and metals, 20: 43982

**RUDERMAN, M. A.,** Anti-matter in the earth's atmosphere, 20: 44037

**RUDNEVA, N. A.,** Effect of Vostok-5 and Vostok-6 flights on primary rootlet chromosomes of plant seedlings, 20: 42909

**RUDOLPH, P. S.,** Ionization of simple hydrocarbons, $H_2$, $D_2$, $O_2$, $H_2O$, and rare gases by 2.2-Mev $\alpha$ particles and by electrons, 20: 44122

**RUDRAN, Kamala,** New technique for determination of $^{14}$C in biological materials (urine), 20: 43136

**RUFF, M. D.,** Effects of x-irradiation on development of Ascaridia galli, 20: 42968

**RUIPEREZ, L. Garzon,** Entropies and laws of boson and fermion distribution considering the classical mixture entropy concept, 20: 44113

**RUKHADZE, A. A.,** Drift-cyclotron oscillations of a collision plasma propagating across a magnetic field, 20: 44968

**RUMFELDT, R. C.,** Radiation-induced addition of HBr to olefins in the liquid phase, 20: 43298

**RUNDO, J.,** Assessment of body content of radioactive Sr following contamination in men, 20: 42779

**RUNDO, J.,** Uptake and retention of radioactive Sr in normal subjects, 20: 42762

**RUPP, A. F.,** Isotopes and Radiation Technology. Vol. 3, No. 4, 20: 43758

**RUPP, G.,** Measurement of critical field $H_{c3}$ and critical surface current in superconducting V–Ti alloys up to 30 kOe, 20: 44535

**RUSSELL, Edwin R.,** Dissolution of thorium oxide, 20: 43412 (DP-1044)

**RUSSELL, J. L. Jr.,** Adequacy of fast and intermediate cross section data from measurement of neutron spectra in bulk media, 20: 44580 (CONF-660303, pp 782-95)

**RUSSELL, J. P.,** Raman scattering in uranium dioxide, 20: 45015

**RUSSELL, K. C.,** Homogeneous nucleation and growth of droplets in vapors, 20: 43674

**RUSSO, G.,** Relativistic impulse approximation for $\pi$-d elastic scattering, 20: 44210

**RUSSO, G.,** Theory of deuteron production in proton-proton collisions, 20: 44196

**RUSSO, S.,** Kinetic features of radiation-induced polymerization of ethylene, 20: 43327

**RUTHERFORD, J. A.,** Charge transfer reactions of nitric oxide with ions of oxygen and nitrogen, 20: 44127

**RUTLEDGE, J. C.,** Department of Industry and Canadian Nuclear Power, 20: 45245

**RUTSCHMANN, J.,** Tritium-labeled cardiac glycosides, 20: 42722

**RYABCHIKOVA, G. G.,** Radiation-thermal cracking of low-octane number straight-run gasoline in uniform temperature field, 20: 43336

**RYABOV, N. V.,** Monitoring U mine atmospheres for short-lived daughter products of Rn, 20: 43594 (AEC-tr-6763)

**RYABTSOV, V. D.,** Bremsstrahlung of electrons with $\bar{E} = 2.4$ Bev, 20: 44190

**RYABUKHIN, Yu. S.,** Ferro-ferri-sulfate method of $\gamma$-radiation dosimetry in radiological experiment, 20: 43696

**RYAN, Jack L.,** Absorption spectra of octahedral lanthanide hexahalides, 20: 43231

**RYAN, Joseph T.,** Radiological recovery requirements, structures, and operations research, 20: 43567 (AD-635820)

**RYBAKOV, N. I.,** Biological effect of space-flight factors using lysogenic bacteria, 20: 42911

**RYBAKOV, N. I.,** Biological studies carried out in satellites, 20: 42912

**RYBAKOV, Yu. P.,** Stability of stationary states of nonlinear vector field, 20: 44392

**RYBAKOVA, K. D.,** Biological studies carried out in satellites, 20: 42912

**RYGAERT, J.,** Radiochemical determination of chlorides dissolved in water, 20: 43063 (EUR-2990.f)

**RYGAERT, J.,** Radiochemical determination of oxygen dissolved in water, 20: 43064 (EUR-2991.f)

**RYHAGE, Ragnar,** Mass spectrometry of biosynthetically labeled ricinine, 20: 43382

**RYNKOVA, N. N.,** Inactivation of 17-oxycorticosteroids in liver of dogs exposed to radiation, 20: 42808

**RYUFUKU, Hiroshi,** Application of orthonormal expansion methods to neutron measurements. I., 20: 43692

**RYUFUKU, Hiroshi,** Application of orthonormal expansion methods to neutron measurements. II., 20: 43693

**RYUFUKU, Hiroshi,** Application of orthonormal expansion methods to neutron measurements. III., 20: 43694

**RYZHOV, N. M.,** Distribution of pressure along a coaxial system after pulsed gas admission, 20: 44978

## S

**SAAVEDRA, O.,** PNC effects in radiative capture of polarized neutrons: case of $^{2}$H(n,$\gamma$) and $^{113}$Cd(n,$\gamma$), 20: 44633 (EUR-3053.e)

**SABATIER, Pierre C.,** Asymptotic properties of the potentials in the inverse-scattering problem at fixed energy, 20: 44321

**SABINE, T. M.,** Proton microanalysis, 20: 43127

**SACHS, Leo,** In vitro cell transformation by x irradiation, 20: 42927

**SACKMAN, John Frank,** Preparation of deutero-hydrocarbons, 20: 43409

**SADYKHOV, F. S.,** Computation of form factors and longitudinal polarization of particle spins in electromagnetic annihilation of $p + \bar{p} \to \mu^- + \mu^+$, 20: 44188

**SAFRONOV, B. G.,** Measuring the energy of recharged particles in an electromagnetic trap, 20: 44976

**SAGAN, Leonard A.,** Human effects of chronic, low dose radiation, 20: 42865

**SAGHER, Daphna,** Selective inactivation of transfer ribonucleic acid, 20: 42809

**SAHAKARI, M. P.,** Tracer study of Liesegang rings. III., 20: 43249

**SAHL, W.,** Breeder reactor development in France, 20: 45157

**SAHLIN, H. L.,** Monte Carlo study of a one-component plasma. I., 20: 44910

**SAIKA, A.,** Effects of excitation energies on nuclear spin coupling constants, 20: 44126

**SAINI, Alberto,** Fluorescence of lanthanum ions in aqueous solutions. III., 20: 43212

**SAINI, G.,** Isotopic mixing in hydrogen chemisorbed on polycrystalline tungsten, 20: 43255

**SAITO, Susumu,** Positive column in a very strong magnetic field, 20: 44917

**SAKSONOV, P. P.,** Biological studies carried out in satellites, 20: 42912

**SAKSONOV, P. P.,** Problem of using radioprotective pharmacological agents under spaceflight conditions, 20: 43004

**SAKSONOV, P. P.,** Radiation protection by mercaptoalkylamines and indolylalkylamines against $\gamma$ rays and proton beams, 20: 43002

**SAKSONOV, P. P.,** Radiation protection during the flight in satellites "Voskhod I" and "Voskhod II", 20: 44990

**SAKSONOV, P. P.,** Radiobiological effects in animals after preliminary action of acceleration, 20: 42985

**SAKURAI, J. J.,** $K_2(\pi_2)$ decay and $\rho$ meson universality, 20: 44238

**SAKURAI, Kunitomo,** Mechanism of solar flares, 20: 44102

**SALAH, Sagid,** Differential and integral thermal-neutron spectra in $D_2O$-moderated lattices, 20: 45090

**SALAM, A.,** Magnetic monopole and two photon theories of C-violation, 20: 44364

**SALAM, A.,** Multiple field relations, 20: 44363

**SALATSKII, V. I.,** Differential cross section of $^{16}$O(t,$\alpha$)$^{15}$N and $^{16}$O(t,p)$^{18}$O reactions at energy range from 0.6 to 1.75 Mev, 20: 44641 (JINR-P-2796)

**SALIKHOV, K. M.,** Effects of admixtures on radiolysis of potassium nitrate, 20: 43329

**SALIMOV, R. A.,** Excitation of ionic-acoustic waves in a potassium and cesium plasma, 20: 44960

**SALTSBURG, Howard,** Molecular-beam scattering from the (111) plane of Ag, 20: 44121

**SALUSTI, E.,** Wave functions of spherical odd-mass nuclei, 20: 44742

**SALYER, Phillip N.,** Effect of W composition on mechanical properties of W–Ni–Fe heavy alloy, 20: 43885 (ASRL-TR-132-2)

**SALZANO, F. J.,** Stability of phases in the Cs–graphite system, 20: 43948

**SAMA, L.,** Niobium coating development for oxidation protection, 20: 43827 (GTR-19)

**SAMA, L.,** Tin–aluminum coatings for the elevated temperature oxidation protection of columbium and columbium-base alloys, 20: 43836 (TID-17070)

**SAMIOS, N. P.,** Evidence against the existence of a strangeness +2 meson resonance at a mass of 1280 Mev, 20: 44262

**SAMOILOV, B. N.,** Polarization of antimony, yttrium, and copper nuclei in iron, 20: 44824

**SAMOILOV, V. P.,** Neutron generator accelerator tubes made with epoxide compounds, 20: 44059

**SAMOILOVA, K. A.,** Influence of ultraviolet radiation on nucleic acid content in Paramecium caudatum. I., 20: 42800 (ORNL-tr-1289)

**SAMOUR, C.,** Properties of partial radiation widths in $^{196}$Pt, 20: 44807

**SAMPAIO, A. Oliveira,** System $U–UMn_2–UAl_2–UFe_2$, 20: 43980

**SAMSONOVA, N. N.,** Effect of V and Mo on properties and phase conversions of $TiCr_2$, 20: 43970

**SAMUEL, D.,** Infrared absorption spectrum of $^{18}$O-labeled glycine, 20: 43283

**SAMUELI, Jean-Jacques,** Nuclear instrumentation in low-energy physics, 20: 43645

**SANCER, Maurice I.,** Boundary conditions for a unique solution to the linearized warm-plasma equations, 20: 44953

**SANCHEZ PALENCIA, Enrique,** Existence theorem for certain stationary states with Reynolds magnetic number zero, 20: 44405

**SANDERS, Wm. Mort,** Interference reduction and sensitivity improvement in activation analysis, 20: 43075 (LA-DC-7931)

**SANDHAS, W.,** Absorptive corrections to reaction $\gamma p \to N^*\pi$ in one-pion exchange model, 20: 44278

**SANDS, George D.,** Cross-linking of polyvinylidene fluoride by gamma radiation, 20: 43371

**SANDSTROEM, Arne Eld,** Prominent Forbush decreases and questionable magnetic disturbances, 20: 44420

**SANDSTROEM, Arne Eld,** Storm sudden commencement and inconspicuous universal time variations of the cosmic ray intensity, 20: 44419

**SANDULESCU, A.,** Barrier penetrabilities and the alpha-nucleus potential, 20: 44763

**SANFORD, P. W.,** High gain saturation effects in proportional counters, 20: 43736

**SANINA, A. V.,** Radiation genetics of Arabidopsis thaliana (L.) heynh. I., 20: 42900

**SANIN-SADER, J.,** Irradiation studies of fruit and vegetables in Latin America, 20: 43783

**SANO, Sadao,** Quantometric analysis of rare earth elements in Mg alloys, 20: 43112

**SANSONI, G.,** Comparing studies of U contents of zircons including their morphology, 20: 43565

**SANSONI, M.,** Finite range of data errors affecting the analysis of a fluctuating excitation function, 20: 44745

**SANTORO, R. T.,** Differential cross sections for production of protons in reactions of 160-Mev protons on complex nuclei, 20: 44649 (ORNL-3887)

**SANTOS, E.,** Estimation of the correlation energy between two paired electrons, 20: 44132

**SANVITO, R.,** Response to radiotriolein test in adults and aged persons, 20: 42782

**SANZ, F.,** Radioprotective properties of 1-phenyl-4,5-(D-glucopyranyl)-imidazoline-2-thione and 1-p-ethoxyphenyl-4-D-arabinyltetrahydroxybutylimidazoline-2-thione, 20: 42979

**SARASWAT, I. P.,** Background radiation in the Roorkee area, 20: 43533

**SARAZIN, Armand,** Nuclear instrumentation in low-energy physics, 20: 43645

**SARGENT, Thornton,** Whole-body counting of $^{47}$Ca and $^{85}$Sr, 20: 42744 (UCRL-16246, pp 19-35)

**SARWINSKI, Raymond Joseph,** Magnetic properties of dilute solutions of liquid $^{3}$He in $^{4}$He at low temperatures, 20: 44502 (COO-1198-382)

**SASAKI, Tsunetaka,** Activation of $TiO_2$ as a decontaminant for radioactive contamination, 20: 43385

**SASLAW, William C.,** Quarks and cosmology, 20: 44089

**SASTRI, M. S.,** Preferential extraction of Ta from fluoride solutions in tributyl phosphate–sulfuric acid system, 20: 43437

**SATCHY, C.,** Versatile $^{60}$Co irradiation facility within a swimming-pool reactor, 20: 43791

**SATO, Kojix,** Chemical effects associated with (n,$\gamma$) and (n,2n) reactions in benzene solutions of ethylbromide and bromobenzene, 20: 43334

**SATO, M.,** Primary x-ray analyzer. II., 20: 43161

**SATO, Masayoshi,** Superconducting transition temperatures of lead alloys, 20: 44515

**SATO, Noriyoshi,** Positive column in a very strong magnetic field, 20: 44917

**SATO, Shigeo,** Symmetry of strong and weak interactions, 20: 44379

**SATO, Shin,** Intersystem crossing of electronically excited dideuteroethylene molecules formed in benzene photosensitization, 20: 43197

**SATO, Teruo,** Night-time abnormal enhancement of ionospheric $F_2$ region electron density, 20: 44473

**SATO, Toshiro,** Chemical effects associated with (n,$\gamma$) and (n,2n) reactions in benzene solutions of ethylbromide and bromobenzene, 20: 43334

**SATO, Yuji,** Activation ($\gamma$,n), 20: 44681

**SATO, Yuji,** Fluorine-19 ($\gamma$,n) cross section from threshold to 14 Mev, 20: 44683

**SATO, Yuji**, Nuclear level of $^{44}$Ca, 20: 44682
**SATSUNKEVICH, I. S.**, Development of resonance with spin $\frac{3}{2}$ in a high-energy neutrino beam, 20: 44276
**SAUDINOS, J.**, Spectroscopy of $^{208}$Pb by inelastic scattering of protons at 24.55 Mev, 20: 44772
**SAUDINOS, J.**, Spectroscopy of $^{207}$Pb by inelastic scattering of 24.5-Mev protons, 20: 44801
**SAULYS, A.**, $\pi^{+}p$ Elastic differential cross sections from 2.3 to 4.0 Bev/c, 20: 44248
**SAUMANDE, P.**, Measurement of radioactivity of water, 20: 43124
**SAUTERON, Jean**, Nuclear fuels, 20: 45099
**SAUZADE, Michel**, High-resolution NMR spectrograph, 20: 43685
**SAVCHENKO, M. A.**, Interaction between electromagnetic, plasma, and spin waves in antiferromagnetic semiconductors and metals, 20: 43982
**SAVKOVIC, Nada**, Effect of local irradiation of head of rats in infantile period on spermatogenesis, 20: 42961
**SAVOSTIN, A. Ya.**, Using magnetic-field pulse modulation for recording original form of NMR and EPR spectra, 20: 43657
**SAWATZKY, Erich**, Method for studying sputtered particles by emission spectroscopy, 20: 43660
**SAWHNEY, B. L.**, Kinetics of cesium sorption by clay minerals, 20: 43455
**SBITNIKOVA, I. S.**, Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)
**SCEPANOVIC, Aleksa**, Radiation damage in steel with medium and high carbon content, 20: 44006
**SCHAD, O.**, Prog. rpt. on pulsating burnout, final, 3/66, 20: 43478 (EURAEC-1620)
**SCHAERF, C.**, Photodisintegration of $^{6}$Li at high energy, 20: 44644 (LNF-66/32)
**SCHALES, Fritz**, Radiation burden in therapeutic use of Th X ($^{224}$Ra), 20: 43046
**SCHAPER, P.**, Contributions to the chemistry of lower U sulfides, 20: 43263
**SCHARFSTEIN, H.**, Algebraic aspects of trilinear commutation relations, 20: 44312
**SCHATZ, A.**, Physics of the AVR Reactor, 20: 45144
**SCHEEL, L. D.**, Chemistry of Be, 20: 43107
**SCHEIBLING, F.**, Transition between rotational bands in $^{16}$O, 20: 44776
**SCHELLENBERG, L.**, Decay of $^{192}$Ir, 20: 44700
**SCHENCK, G. F.**, Nb-1 Zr alloy Li corrosion loop tests, 20: 43837 (TIM-823)
**SCHENK, M.**, Shift of transformation points between crystalline phases through lattice defects, 20: 45034
**SCHEPOT'EVA, E. S.**, Maximum permissible concentrations of thoron ($^{220}$Rn) and its daughter products in air of working premises, 20: 43603
**SCHERAGA, Harold A.**, Structural studies of ribonuclease. XXIV., 20: 43281
**SCHERMER, R. I.**, Spin dependence of the reaction $^{3}$He(n,p)T and the nuclear susceptibility of adsorbed $^{3}$He, 20: 44804
**SCHIAGER, Keith J.**, Inhalation hazards of radon decay products in U mines, 20: 43617
**SCHIAVON, P.**, A measurement of the branching ratio $\omega \rightarrow$ neutrals/$\omega \rightarrow \pi^{+} + \pi^{-} + \pi^{0}$, 20: 44176 (LNF-66/31)
**SCHIFF, L. I.**, Nonrelativistic quark model, 20: 44254
**SCHIFF, L. I.**, Quarks and magnetic poles, 20: 44261
**SCHILB, J. D.**, Preparation of $^{24}$Mg from $^{24}$MgO, 20: 44717
**SCHILLING, G.**, Strontium-90 contamination in area of German Democratic Republic, 20: 43538
**SCHILLING, Heinz**, Plasma diagnostics from ray displacement during reflection of linear or elliptically polarized waves, 20: 44885
**SCHILLING, W.**, Stored energy, volume, and resistivity change in neutron-irradiated Al, 20: 45037
**SCHLECHTE, Michiel**, Method for electrolytic production of uranium dioxide crystals, 20: 43266
**SCHLUETER, A.**, Axisymmetric magnetohydrostatic equilibria, 20: 44858 (IPP-6/48)
**SCHLUMBERGER, J. R.**, Treatment of acute leukemia—actual and possible results, 20: 43045
**SCHMELZER, Ch.**, Average charge of stripped heavy ions, 20: 44136
**SCHMIDT, F. A.**, Electrotransport of C, N, and O in Th, 20: 43820
**SCHMIDT, G. B.**, Chemical reactions of nuclear recoil atoms in bromopentammine Rh(III)nitrate and chloropentammine Ir(III)chloride, 20: 43340
**SCHMIDT, J.**, High-sensitivity magnetic resonance by bolometer detection, 20: 45007
**SCHMIDT, R.**, Epithermal fused-salt thorium breeder, 20: 45155
**SCHMIDT, W.**, Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 $F^{-2}$, 20: 44253
**SCHMITT, R.**, Discrimination of nuclear tracks in ionographic emulsion by electron microscopy, 20: 43731
**SCHMITZ, D.**, Single photoproduction of neutral $\pi$-mesons on hydrogen at small angles between 1.3 and 3 Bev, 20: 44242
**SCHMITZ, P.**, Decay angular distributions of resonances in two-body reactions produced by 8 Bev/c positive pions on protons, 20: 44226
**SCHNEID, Edward J.**, Study of (d,p) and (d,t) reaction on the $^{136}$Xe isotope, 20: 44842
**SCHNEIDER, Christel**, Recent results on the $\gamma$-radiation-induced polymerization of some vinyl monomers in emulsion systems, 20: 43374
**SCHNEIDER, H.**, Experimental test of time-reversal invariance in $\Sigma^{0} \rightarrow \Lambda^{0} + e^{+} + e^{-}$, 20: 44251
**SCHNEIDER, M.**, Treatment of acute leukemia—actual and possible results, 20: 43045
**SCHNIZLEIN, J. G.**, Ignition of uranium, 20: 43611
**SCHNIZLEIN, J. G.**, Ignition of binary alloys of uranium, 20: 43612
**SCHOENING, J.**, Helium purification installation (AVR), 20: 45142
**SCHOLZ, U.**, Coolant blower (AVR), 20: 45141
**SCHONFELD, Ernest**, Alpha M: computer program for determining radioisotopes by least-squares resolution of $\gamma$-ray spectra, 20: 43078 (ORNL-3975)
**SCHOOLEY, John C.**, Responsiveness of hematopoietic tissue to erythropoietin, 20: 42713 (UCRL-16246, pp 107-18)
**SCHOTSMANS, L.**, Hartree-Fock type calculation of $^{12}$C, 20: 44779
**SCHOWEN, Richard L.**, Solvent isotope effects in amide hydrolysis, 20: 43280
**SCHREIBER, Richard E.**, Irradiation of $UO_2$ and UC, at high specific power to high burnups, post irradiation examination of capsule 1, 20: 45097 (WCAP-2972)
**SCHREYER, C. H.**, Prog. rpt. on ceramic materials for reactor applications, 7/61–6/62, 20: 43900 (NBS-D-150)
**SCHREYER, C. H.**, Prog. rpt. on ceramic materials for reactor application, 7/62–6/63, 20: 43901 (NBS-D-154)
**SCHRIEFFER, J. R.**, Effect of ferromagnetic spin correlations on superconductivity, 20: 44549
**SCHROEDER, Jerzy**, Possibility of reduction of chemicals consumption in U ore leaching process, 20: 43441
**SCHROEDER, K.**, Contamination of poultry meat and egg products with $^{137}$Cs, 20: 42735
**SCHUEBELIN, P.**, Structure within the R(1675) boson and possible structure within the $A_2$(1290), 20: 44245
**SCHUHL, C.**, Deformation of the Ho nucleus, 20: 44710
**SCHULTEN, R.**, Development history of the AVR reactor, 20: 45129
**SCHULTEN, R.**, High-temperature reactor as breeder, 20: 45154
**SCHULTEN, R.**, Thorium breeders, 20: 45152
**SCHULZE, Horst W.**, Recording pulse density and time rate of broad detector signals, 20: 43643
**SCHULZE, K. P.**, Measurement of effective ionization energy in gases, 20: 43193
**SCHUMACHER, David P.**, Magnetic characteristics of some lanthanide nitrides, 20: 43939
**SCHUSTER, H.**, Experience with automatic deflector for Rossendorf cyclotron, 20: 44050
**SCHUTTEN, J.**, Luminescence caused by proton impact with special reference to the lunar surface, 20: 44035
**SCHWARTZ, J. J.**, Studies of the $^{12}$C($^{3}$He,$^{3}$He)$^{12}$C and $^{12}$C($^{3}$He,$\alpha_0$)$^{11}$C reactions, 20: 44728
**SCHWARTZ, R. S.**, X-radiation and alkylating agents as trigger mechanisms in autoimmune complications of malignant lymphoproliferative disease, 20: 43027
**SCHWARZ, George**, Changes in RBE of a 35-Mev electron beam as function of tissue depth, 20: 42974
**SCHWARZ, S.**, Multiple scattering of fast neutrons in $^{10}$B-glass scintillators, 20: 43700
**SCHWARZENBERG, L.**, Treatment of acute leukemia—actual and possible results, 20: 43045
**SCHWEIGER, F.**, Problems in the planning and construction of the AVR Research Nuclear Power Plant, 20: 45132
**SCHWEIGER, F.**, Startup and operation testing (AVR), 20: 45145
**SCHWEITZER, D. G.**, Some details of flux retention processes in hysteretic superconductors, 20: 44521
**SCHWEITZER, S.**, Prog. rpt. on direct-energy conversion systems, 3–5/65. I., 20: 44163 (AD-628528
**SCHWETLICK, K.**, Deuterium isotope effect in reaction of tert-butoxy radicals with aliphatic ketones, 20: 43284
**SCHWIERS, H. G.**, Reactor pressure vessel and load-bearing installations (AVR), 20: 45136
**SCHWINK, Ch.**, Strengthening mechanism in neutron-irradiated Cu single crystals. I., 20: 45031
**SCHWOB, P.**, Magnetic transitions in EuSe, 20: 44523
**SCOSSIROLI, R. E.**, Induction of new genetic variability for quantitative traits by seed irradiation, 20: 42846 (IAEA-2466-13)
**SCOSSIROLI-PELLEGRINI, S.**, Induction of new genetic variability for quantitative traits by seed irradiation, 20: 42846 (IAEA-2466-13)
**SCOTT, C. D.**, Fluorination—vacuum-distillation system for regenerating fuel and fertile streams in MSBR, 20: 43422 (ORNL-3791)
**SCOTT, Kenneth Thomas Bartlett**, Preparation of deutero-hydrocarbons, 20: 43409
**SCOVILLE, J. J.**, Interpretation and evaluation of integral cross sections

by reactivity measurements, 20: 44621 (CONF-660303, pp 773-81)
**SCRUTTON, Michael C.**, Pyruvate carboxylase. VI., 20: 42773
**SCULLY, M. O.**, Energy loss and straggling of alpha particles in metal foils, 20: 44144
**SEARCY, Alan W.**, Applied thermodynamics in high-temperature refractories systems, 20: 43913 (UCRL-16256)
**SEARS, R.**, New $T \geq 1$ Di-pion at 965 Mev, 20: 44229
**SEASE, J. D.**, Remotely operated equipment for fabricating HFIR target elements, 20: 45204 (ORNL-P-2410)
**SEATZU, S.**, Reactions $d(p,\gamma)^3He$ and $d(n,\gamma)^3H$, 20: 44748
**SEBESTY'EN, K.**, Well-logging in bauxite-prospecting neutron activation logging, 20: 43554
**SEDA, Josef**, Resolution limits in radiography, 20: 43494
**SEEGER, Philip A.**, Dependence of nucleosynthesis abundance calculations on the mass law, 20: 44070 (LA-DC-7885)
**SEEMANN, K. W.**, Polyethylene double differential inelastic scattering cross sections for epithermal neutrons, 20: 44576 (CONF-660303, pp 122-33)
**SEETZEN, J.**, Plutonium supply of the German fast breeder prototype reactors, 20: 45151
**SEGEL, R. E.**, Lowest $T = \frac{3}{2}$ state in $^{29}P$, 20: 44790
**SEIDEL, G. P.**, Strengthening mechanism in neutron-irradiated Cu single crystals. II., 20: 45032
**SEITZ, Larry M.**, Organometallic exchange reactions. III., 20: 43393
**SEKAMOVA, E. N.**, Effects of external $\alpha$-irradiation on intensity of growth of cells in vitro, 20: 42943
**SEKINE, Katsuhiko**, Generalization of Levinson's theorem, 20: 44293
**SELBIN, J.**, Developments in chemistry of transition metal oxocations, 20: 43190
**SELBY, T. W.**, Gravimetric gas flow standard, 20: 43633 (K-1632(Pt.1))
**SELECKI, Anatol**, Isotopic composition of water from Tarnobrzeg basin, 20: 43531
**SELETKOVA, N. I.**, Uptake and distribution of Ca and of microquantities Sr in plants, 20: 42766
**SELL, A.**, Acute gastric ulcers induced by radiation, 20: 43019
**SELLERI, F.**, Theory of deuteron production in proton-proton collisions, 20: 44196
**SELTZER, Stanley**, Secondary $\beta$-deuterium isotope effect and the cage effect in thermal decomposition of azobis-$\alpha$-phenylethane, 20: 43278
**SEMASHKO, N. N.**;, Lifetime of individual charged particles in mirrored magnetic trap, 20: 44855 (IAE-1078)
**SEMENOVA, N. K.**, Basic exchange H reaction of nitrous heterocycles in liquid ammonia, 20: 43216
**SEMENOVA, T. A.**, Vavilov-Cherenkov radiation in a medium with two cylindrical boundaries, 20: 44273
**SEN, Shyamali**, Use of bismuth iodate in separation of tetravalent actinides, 20: 43448
**SENBA, Kei**, Two-pion-exchange potential with nucleon pairs, 20: 44271
**SEPTIER, A.**, Permanent-magnet multipolar lens with variable focusing, 20: 44063
**SEPTIER, Albert**, Towards the design of an objective using quadrupole lenses and currected for aperture aberrations, 20: 44047
**SERDULA, K.**, Determination of radial buckling in reflected systems, 20: 45085
**SERDYUK, L. S.**, Lanthanum reactions with boropyrocatechin violet complex, 20: 43223
**SEREBRENNIKOV, V. V.**, Ion hydrolysis of rare earths and Y in aqueous solutions, 20: 43221
**SERGEJTSCHIK, E.**, Special devices of the AVR Reactor. Steam generator, 20: 45137
**SERLEMITSOS, Peter**, Extended source of energetic cosmic x rays, 20: 44095
**SERPAN, C. Z. Jr.**, Prog. rpt. on irradiation effects on reactor structural materials, 8–10/65, 20: 43997 (NRL-Memo-1663)
**SERWAY, R. A.**, Electron spin resonance absorption spectrum of the $AsO_3^{2-}$ molecule ion in $\gamma$-irradiated single-crystal calcite, 20: 45010
**SESSLER, A. M.**, Wake fields of a pulse of charge moving in a highly conducting pipe of circular cross section, 20: 44052
**SESSLER, G. M.**, Ion-wave propagation in gas discharges at frequencies higher than the ion plasma frequency, 20: 44930
**SEUFERT, H.**, Device for digital dead-time correction of counting losses of single and coincidence counting rates, 20: 43713
**SEVERNE, G.**, Statistical mechanics of gravitational plasmas, 20: 44948
**SEYMOUR, Allyn H.**, Distribution of $^{65}Zn$ in plankton from offshore waters of Washington and Oregon, 1961–1963, 20: 43545
**SGOUTAS, Demetrios S.**, Isotope fractionation of methyl esters by gas-liquid chromatography, 20: 43394
**SHABADASH, A. L.**, Cytology and cytochemistry of ribonucleoproteins in nervous system during latent period of radiation damage, 20: 42866
**SHAFRANOV, V. D.**, Perturbation of magnetic surfaces, 20: 44028 (IAE-1150)
**SHAH, J.**, Radiation-induced Ca release and its relation to textural changes in fruits and vegetables, 20: 42815
**SHAHANI, C. J.**, Mass yields of $^{99}Mo$, $^{105}Rh$, and $^{132}Te$ in the spontaneous fission of $^{238}U$, 20: 44815
**SHAKHOV, E. M.**, Nonstationary magnetic field diffusion into plasma cooled by solid walls, 20: 44905
**SHALAEVSKII, M. R.**, Chemical properties of element 104, 20: 43192
**SHALEK, R. J.**, Use of lithium fluoride dosimeters for in vivo measurement of transmission through bone and lung, 20: 43747
**SHALIMOV, V. P.**, Charged particle motion in magnetic dipole field. II., 20: 44461
**SHAL'NOV, M. I.**, Radiation protection effects of DNA, RNA, RNA hydrolyzate and orotic acid on leukopoiesis in rabbits and rats, 20: 42937
**SHAL'NOVA, G. A.**, Autoflora as an indicator of radiative injury of an organism, 20: 43052
**SHAMOS, M. H.**, Measurement of intensity of cosmic-ray ionization at sea level, 20: 44456
**SHANK, Ralph C.**, Prog. rpt. on analytical chemistry, annual, 1965, 20: 43066 (IDO-14679)
**SHANKAR, J.**, Annealing behavior of neutron-irradiated tris-dipyridyl Co(III) perchlorate in hydrated form, 20: 43366
**SHANTYR, V. I.**, Problems of experimental and clincial radiobiology, 20: 42796
**SHAPIRO, S.**, Far-infrared response of point-contact Josephson junctions, 20: 44548
**SHAPOVAL, E. A.**, Critical fields of thin superconducting films. II., 20: 44574
**SHAREVSKII, B. A.**, Pre-heated diffusion pumps, 20: 43498
**SHARKHATUNYAN, P. O.**, Ionization measurements in streamer chamber, 20: 43691
**SHASHKOV, V. S.**, Problem of using radioprotective pharmacological agents under spaceflight conditions, 20: 43004
**SHASHKOV, V. S.**, Radiation protection by mercaptoalkylamines and indolylalkylamines against $\gamma$ rays and proton beams, 20: 43002
**SHASTRI, L. V.**, Radiolysis of aqueous solutions, 20: 43357
**SHATAS, R. A.**, Stress effects on 9572 $cm^{-1}$ line in irradiated MgO, 20: 45025
**SHAY, Dennis**, Spin-one particle in an external electromagnetic field, 20: 44480 (IS-T-95)
**SHCHELEV, M. Ya.**, Stabilized power supply for electron-optical converters, 20: 43656
**SHCHERBAKOVA, M. N.**, Quasi-nucleon interactions between 24 Bev/c protons and nuclei of a photographic emulsion in a strong magnetic field, 20: 44280
**SHEA, K. G.**, USAEC program on marine products irradiation, 20: 43774
**SHEAHEN, Thomas P.**, Superconducting transition and critical field of pure gallium single crystals, 20: 44545
**SHEBANOV, V. A.**, Remarks on investigation $\pi^-$-p interactions in heavy liquid bubble chambers, 20: 44177 (NP-16278)
**SHECHTER, H.**, Moessbauer spectrometer calibration using $^{57}Fe$ enriched metallic iron, 20: 43707
**SHELDON, E.**, Remarks on the physical interpretation of SU(6,6) theory, 20: 44302
**SHELDON, Eric**, Group-theoretical approach to the pairing interaction in the translationally invariant shell model, 20: 44699
**SHELEST, A. E.**, Thermomechanical treatment of the $\beta$ alloy of the Ti–Mo–Cr–Fe–Al system, 20: 43961
**SHELTON, Samuel V.**, Variable collision cross-section effects on electrical conductivity, 20: 44877
**SHELTON, W. N.**, Test of the microscopic theory of the nuclear gamma vibration, 20: 44797
**SHEN, Benjamin C.**, Evidence for a K*(1320) resonance, 20: 44265
**SHEPPARD, R. H.**, Human Ca metabolism using long-term whole body tracer measurements, 20: 42764
**SHER, A.**, Temperature variation of $^{139}La$ nuclear quadrupole resonance in $LaF_3$, 20: 45026
**SHERMAN, Arthur**, Prog. rpt. on extra thermal ionization and MHD flows, final, 10/15/65, 20: 44402 (AD-628065)
**SHERMAN, Warren V.**, Gamma radiolysis of liquid 2-propanol. II., 20: 43318
**SHIBAEVA, N. P.**, Express method for separating ionium ($^{230}Th$) from sulfuric acid uranium solutions, 20: 43147
**SHIDA, Tadamasa**, Molecular ions in radiation chemistry. IV., 20: 43313
**SHIDA, Tadamasa**, Molecular ions in radiation chemistry. V., 20: 43314
**SHIELDS, L.**, Radiation-induced atomic silver in pyrex and sodium tetraborate glasses, 20: 44012
**SHILLINGER, Yu. I.**, Metabolism of vitamins in dogs fed meat products pasteurized by $\gamma$ irradiation, 20: 42793
**SHILOV, B. V.**, Chemical properties of element 104, 20: 43192
**SHIMIZU, Masao**, Dispersion relation of a plasmon in an electron gas, 20: 44916
**SHIOKAWA, Takanobu**, Chemical effects associated with $(n,\gamma)$ and (n,2n) reactions in benzene solutions of ethylbromide and bromobenzene, 20: 43334
**SHIPMAN, Thomas L.**, History of Be disease, 20: 42751

**SHIROKOV, Yu. M.,** Relation between the form-factor of a single particle matrix element of the energy-momentum tensor and the charge and magnetic moment, 20: 44391

**SHIROKOVA, I. P.,** A steady-state induced discharge, 20: 44961

**SHIROTAMI, Takeshi,** Application of orthonormal expansion methods to neutron measurements. III., 20: 43694

**SHISHELOV, A. A.,** Influence of irradiation on properties of monocrystals of lithium fluoride, 20: 43307

**SHKODA-ULYANOV, V. A.,** Determination of oil–water interface based on delayed neutron detection, 20: 43553

**SHMUSKOVICH, N. N.,** Radiation protection effect of apilac in animals, 20: 43009

**SHOHET, J. L.,** Eigenfrequencies of microwave cavity partially filled with magnetized plasma, 20: 44907

**SHORE, R. G.,** Sign of interactions between $Nd^{+3}$ ions in $LaCl_3$, 20: 45027

**SHORIN, K. N.,** Method for improving magnetic shielding effeciency, 20: 44060

**SHPAKOV, B. I.,** Computation of partial and complete yields of fission fragments, 20: 44819

**SHPIGEL, I. S.,** Experiments with Stellarator L-1, 20: 44874 (MATT-Trans-36)

**SHPINEL, V. S.,** Magnetic hyperfine structure of $^{155}Gd$ levels in Gd and $GdAl_2$, 20: 44832

**SHREVE, D. C.,** Tests of time-reversal invariance in the reactions $^{24}Mg + d \rightleftarrows {}^{25}Mg + p$, 20: 44805

**SHUBIN, A. S.,** Ultrastructures of thymus cells in mice suffering from radiation leukemia, 20: 42882

**SHUGAR, Dawid,** Inactivation of solutions transforming DNA with aid of $\gamma$ radiation, 20: 42818

**SHUKHMAN, V. A.,** Destruction of thin film superconductivity by current pulses, 20: 44511

**SHULENOK, P. F.,** New technique for chemical-thermal treatment of transition metals in molten aluminum-base alloys, 20: 43962

**SHULTZ, Jeffrey S.,** Identification of thyroidal iodoamino acids by gel filtration and automated $^{127}I$ determination, 20: 42774

**SHURE, F.,** Space and energy effects in reactor fluctuation experiments, 20: 45081

**SHUTE, G. G.,** Measurement and analysis of high energy gamma-ray spectra, 20: 43702

**SHUVALOV, I. K.,** Intensity distribution in induced combinational scattering spectra, 20: 44148

**SHVACHUNOV, K. N.,** Charged particle motion in magnetic dipole field. II., 20: 44461

**SHVEIKIN, G. P.,** Standard heat of formation of Nb carbides in NbC phase, 20: 43261

**SIBONY, Daniel,** Principle of maximum and minimum in potential theory, 20: 44300

**SICILIANO, A.,** Anomalies induced by ionizing radiation on human chromosomes, 20: 42931

**SICILIANO, A.,** Dose estimation to active bone marrow in medical uses of ionizing radiation, 20: 43620

**SIDHAYE, Leela,** Tracer study of Liesegang rings. III., 20: 43249

**SIDORKIN, V. A.,** Measuring the energy of recharged particles in an electromagnetic trap, 20: 44976

**SIDOROV, B. N.,** Analysis of initial radiation effects on chromosomes, 20: 42936

**SIDOROV, V. M.,** Helium-8 production in negative pion capture by carbon and oxygen nuclei, 20: 44770

**SIEMASZKO, Aleksander,** Influence of surface-active agents on the effect of decontamination, 20: 43579 (INR-725/XXII/C)

**SIFFERT, P.,** Charge collection time of lithium-compensated silicon radiation detectors, 20: 43703

**SIGNER, P.,** Trapping of the solar wind in solids. I., 20: 44697

**SILICH, U. F.,** Lanthanum reactions with boropyrocatechin violet complex, 20: 43223

**SILL, Claude W.,** Preparation of $^{233}Pa$ tracer, 20: 43383

**SILVERMAN, M. S.,** Effect of macrophages from irradiated donors on ability to transfer antibody formation, 20: 42830 (AD-635598)

**SILVESTRINI, V.,** A measurement of the branching ratio $\omega \rightarrow$ neutrals/$\omega \rightarrow \pi^+ + \pi^- + \pi^0$, 20: 44176 (LNF-66/31)

**SIMMONS, David J.,** Strontium retention in mice treated with thyroid hormone, 20: 42769

**SIMON, K.-H.,** Comment on the multiple emission of secondary electrons, 20: 44112 (ORNL-tr-1266)

**SIMON, M.,** Shock waves in the interplanetary medium, 20: 44098

**SIMONEK, Jiri,** Analysis of heat transfer in fuel element bundles, 20: 43489

**SIMONOV, Yu. A.,** Three-body problem: equation for partial waves, 20: 44499

**SIMONOV, Yu. A.,** Complete angular function set in the three-body problem for an arbitrary orbital momentum, 20: 44500

**SIMPSON, F. H.,** Prog. rpt. on macrolaminate particle composite material development, 6/65–7/66, 20: 43845 (AD-637573)

**SIMPSON, Ferrol B.,** Problems associated with the analysis of total cross section data of radioactive samples, 20: 44604 (CONF-660303, pp 67-74)

**SIMPSON, O. D.,** Analytical descriptions of the sub-cadmium cross section of $^{233}U$, $^{235}U$, $^{239}Pu$, and $^{241}Pu$, 20: 44629 (CONF-660303, pp 985-96)

**SIMPSON, O. D.,** Fission cross section of $^{241}Pu$ from 20-200 ev as determined from a nuclear explosion, 20: 44625 (CONF-660303, pp 910-18)

**SIMPSON, O. D.,** Measurement and analysis of cross sections of fissile nuclides, 20: 44623 (CONF-660303, pp 840-72)

**SINAISKII, E. G.,** Nonstationary magnetic field diffusion into plasma cooled by solid walls, 20: 44905

**SINEL'NIKOV, K. D.,** Confinement of charged particles pulse-injected into a trap with stationary fields, 20: 44972

**SINEL'NIKOV, K. D.,** Injection of particles into a mirror trap through magnetic cusp configuration, 20: 44917

**SINEL'NIKOV, K. D.,** Magnetic traps, 20: 44970

**SINEL'NIKOV, K. D.,** Motion of a plasma jet across a nonuniform magnetic field, 20: 44963

**SINGH, Bikram,** Tagging of hippuran with radioiodine ($^{131}I$), 20: 43403

**SINITSYN, V. I.,** Inhibition of instabilities in a plasma column, 20: 44964

**SITTE, R.,** Remotely operated pipetting device, 20: 43077 (NP-16214)

**SIVARAM, B. M.,** Horizontal drift and anisotropy in the F1 region, 20: 44440

**SIVERTSEN, David R.,** Anomalous effect of electron beam irradiation on silicon and germanium, 20: 44998

**SIVKOVA, V. G.,** Mechanism of impairment of oxidative phosphorylation in tissues of irradiated animals, 20: 42825

**SKANSEN, Terje,** Crystal structures of $Mo_2As_3$ and $W_2As_3$, 20: 43187

**SKIBENKO, A. I.,** Determination of the spatial density distribution of a plasma using microwave refraction, 20: 44982

**SKIBENKO, A. I.,** Microwave refraction by a nonhomogeneous cylindrical plasma, 20: 44981

**SKIBENKO, A. I.,** Studying a plasma by probing with microwaves, 20: 44983

**SKLYAREVSKII, V. V.,** Polarization of antimony, yttrium, and copper nuclei in iron, 20: 44824

**SKOFF, G.,** Electron beam depth dose measurements, 20: 43040

**SKOOG, D. A.,** Hydrolysis constant of quadrivalent cerium from spectrometric measurements, 20: 43189

**SKOPIK, D. M.,** Measurement of the mean energy required to create an electron-hole pair in silicon between 6 and 77°K, 20: 45028

**SKULACHEV, V. P.,** Mechanism of impairment of oxidative phosphorylation in tissues of irradiated animals, 20: 42825

**SKULME, K. A.,** Changes in blood Fe content and erythropoiesis indexes under influence of radiation, 20: 42908

**SKURATOV, S. M.,** Standard heat of formation of Nb carbides in NbC phase, 20: 43261

**SKURIDIN, G. A.,** Motion of charged particles in the vicinity of the neutral point, 20: 44460

**SLABOSPITSKII, A. P.,** Investigation of a nonadiabatic magnetic trap, 20: 44977

**SLAPA, Mieczyslaw,** Semiconductor system for charged particles identification, 20: 43717

**SLAUGHTER, G. M.,** Irradiation embrittlement of welds and brazes at elevated temperatures, 20: 44027

**SLAVIN, J. W.,** Quality and wholesomeness of radiation-pasteurized marine products, 20: 43768

**SLAVNOV, A. A.,** Simple dynamical model for baryon resonances, 20: 44365

**SLEIGHT, Arthur W.,** Crystal structure of $Nb_{16}W_{18}O_{94}$, a member of a $(MeO)_xMeO_3$ family of compounds, 20: 43188

**SLEPTSOV, L. E.,** Infrared absorption spectrum of monocrystals of sodium uranyl acetate, 20: 43285

**SLIV, L. A.,** Tables giving internal conversion coefficients of gamma-radiation on the K- and L-shells, 20: 44664 (BNL-tr-65)

**SLIVNIK, J.,** Fluorine magnetic resonance shifts in paramagnetic $PuF_4$, 20: 43208

**SLOAN, T.,** Observation of x-rays from spark discharges in a spark chamber, 20: 43714

**SLOSEK, T. J.,** Production of isotopes in commercial reactors, 20: 43803

**SLOVINSKII, B.,** Radiative unit and critical energy in Xe, 20: 44642 (JINR-P-2808)

**SLOWEY, J. F.,** Rare earth distribution in waters of Gulf of Mexico, 20: 43087 (TID-23295, Sect. 4)

**SLOWEY, J. Frank,** Neutron activation analysis of Ru in sea water, 20: 43086 (TID-23295, Sect. 3)

**SLOWEY, James Frank Jr.,** Distribution of Cu, Mn and Zn in ocean using neutron activation analysis, 20: 43085 (TID-23295, Sect. 2)

**SLUCHEVSKAYA, V. M.,** Inelastic scattering of neutrons, 20: 44668 (INDSWG-101, pp 73-108)

**SLUTSKII, M. E.,** High-sensitivity radio-frequency mass spectrometer for investigating ionic and neutral composition of upper atmosphere, 20: 43648

**SLYUSAREV, V. A.,** Electrodynamics of the Josephson effect, 20: 44571

**SLYUSAREV, V. A.,** Theory of superconductor tunneling, 20: 44570

**SMALL, Lawrence F.**, Prog. rpt. on element and energy transfer in lower trophic levels in marine environment, 4/63–3/66, 20: 42731 (RLO-1751-2)

**SMETS, L. A.**, Radiation-induced inhibition of thymidine incorporation by mammalian cells in vitro, 20: 42777

**SMILEY, S. H.**, Mechanically agitated fluid beds applied to hydrofluorination of UO powders, 20: 43198

**SMIRIN, L. N.**, Electrolytic cell for radioactive isotopes, 20: 43395

**SMIRNOV, Yu. N.**, Crystal structure of Tb at 120 to 300°K, 20: 45043

**SMIRYAGINA, S. A.**, Influence of irradiation on properties of monocrystals of lithium fluoride, 20: 43307

**SMITH, A. B.**, Inelastic neutron scattering: a compendium, 20: 44613 (CONF-660303, pp 577-98)

**SMITH, A. M.**, Ionization loss by relativistic electrons, 20: 44232

**SMITH, Alan R.**, Radioactivity of cement raw materials, 20: 43514 (UCRL-16878)

**SMITH, D. K.**, Mineralogical investigations in debris of Gnome event near Carlsbad, New Mexico, 20: 43464

**SMITH, E. T.**, Prog. rpt. on effects of various combination of nuclear radiation, vacuum, and cryotemperatures on engineering materials, 5/64–5/66, 20: 43994 (FZK-290)

**SMITH, Gerard V.**, Mechanism of metal-catalyzed hydrogenation and exchange. Phenyl effect, 20: 43279

**SMITH, Gordon M.**, High pressure $^3$He gas scintillation neutron detector, 20: 43733

**SMITH, H. L.**, Thermal neutron-induced fission cross section of $^{242m}$Am, 20: 44708

**SMITH, Harold H.**, Factors influencing variation in RBE in irradiation of maize seeds, 20: 42843 (BNL-10358)

**SMITH, Harold H.**, Genetic tobacco tumors and problem of differentiation, 20: 42704 (BNL-967)

**SMITH, J. H.**, Experimental investigation of CP violation in $K_{e30}$ decays, 20: 44259

**SMITH, J. H.**, Test of time-reversal invariance in $K_{10} \rightarrow \pi^- + \mu^+ + \nu$, 20: 44252

**SMITH, J. L.**, P-V-T and internal energy data for He between 4.2 and 20°K at pressures of 100-1,300 atm, 20: 44507

**SMITH, J. Richard**, Techniques for determining ETA for the thermally fissionable isotopes, 20: 44626 (CONF-660303, pp 919-32)

**SMITH, James C.**, Prog. rpt. on use of ionizing radiation as stimuli, 6/65–5/66, 20: 42852 (ORO-2903-28)

**SMITH, Joe N. Jr.**, Molecular-beam scattering from the (111) plane of Ag, 20: 44121

**SMITH, L. H.**, Spark chamber for gamma-ray astronomy, 20: 43734

**SMITH, Lawrence H.**, Upper limits to cosmic $\gamma$ rays in the range 30 to 500 Mev, 20: 44947

**SMITH, P. J.**, Prog. rpt. on electron transmission study of oxide particle statistics in TD-nickel alloy, 5/65–4/66, 20: 43882 (AD-636487)

**SMITH, R. C.**, Plutonium: steam oxidation and oxide dissolution, 20: 43854 (HW-66431)

**SMITH, T. F.**, Calorimetric investigation of superconductivity in alpha uranium, 20: 44504 (UCRL-17026)

**SMITH, T. F.**, Heat capacity of $\alpha$ U at a pressure of 10 kbar, between 0.3 and 6°K, 20: 44557

**SMITH, W. A.**, Heated glass cathodes in electrostatic beam separators, 20: 44046

**SMITH, W. A. Jr.**, Radiation induced electrical phenomena in organic dielectrics, 20: 43991 (EGG-1183-2096)

**SMITH, W. J. S.**, Production of thorium oxide for vibratory compaction by a modified sol-gel process, 20: 43850 (CONF-660524-15)

**SMITHRICK, John J.**, Neutron flux albedo for concrete, 20: 44988 (NASA-TX-X-1287)

**SMOLIN, G. G.**, Two-dimensional isothermal flow of conducting liquid and gas in channel with electric and magnetic fields, 20: 43490

**SMOLYAK, V. A.**, Automatic and nuclear radiation control of industrial processes, 20: 43789

**SMOLYANKINA, T. G.**, Spark chambers for recording slow particles, 20: 43724

**SMORODIN, Yu. A.**, Inconsistencies of data on cosmic rays with energies above $10^{11}$ ev, 20: 44162

**SNEAD, C. L. Jr.**, Stage I recovery of pure Ag and the correspondence with Cu, 20: 44022

**SNYDER, Conway W.**, Mariner 2 observations of solar wind. I., 20: 44078

**SNYDER, H. A.**, Angular dependence of mutual friction in rotating He II, 20: 44539

**SNYDER, Thoma M.**, Future cross section needs of the nuclear power industry, 20: 45107 (CONF-660303, pp 1025-34)

**SOBICZEWSKI, A.**, Closed shells for $Z > 82$ and $N > 126$ in a diffuse potential well, 20: 44640 (JINR-P-2793)

**SOBICZEWSKI, A.**, Closed shells for $Z > 82$ and $N > 126$ in a diffuse potential well, 20: 44774

**SOBOLEV, S. S.**, High-voltage nanosecond pulse generator, 20: 43655

**SODAN, H.**, Energy levels and rotation-particle coupling in $^{155}$Eu, 20: 44736

**SODERQUIST, Charles E.**, Liquid scintillation spectrometer detection chamber, 20: 43748

**SOEHNGEN, G.**, Scattering of polarized neutrons by $\alpha$ particles, 20: 44732

**SOEREMARK, Rune**, Use of short-lived nuclides in medical research, 20: 43022

**SOERENSEN, H.**, Stopping power of Al for 5- to 12-Mev protons and deuterons, 20: 44034

**SOKOLOV, N. M.**, Separation coefficients of $^{12}$C and $^{14}$C by equilibrium of methane, 20: 43093 (BNL-tr-84)

**SOKOLOV, N. N.**, Analysis of initial radiation effects on chromosomes, 20: 42936

**SOKOLOVA, T. N.**, Measurements of activity of radioactive gases by spherical ionization chamber, 20: 43106

**SOKOLOVSKII, V. V.**, Spark chambers for recording slow particles, 20: 43724

**SOLEILHAVOUP, Jean-Pierre**, Biological activity of natural ionizing radiations, 20: 42886

**SOLOMATIN, V. F.**, Cooled photomultipliers of FEU-39 and GEU-46A types, 20: 43723

**SOLOMON, I.**, High-sensitivity magnetic resonance by bolometer detection, 20: 45007

**SOLOVEV, L. S.**, Perturbation of magnetic surfaces, 20: 44028 (IAE-1150)

**SOLOV'EV, V. Ya.**, Production technology of Nb and Nb alloys, 20: 43984

**SOLOVEVA, N. A.**, Thermal expansion of the solid solutions of refractory metals of the IV, V, and VI groups of the periodic system, 20: 43964

**SOLOVIEV, V. G.**, Energies of the octupole states of even-even nuclei in the energy region $228 \leqq A \leqq 254$, 20: 44751

**SOMBRET, C.**, Continuous calcination of molybdenum solutions. II., 20: 43186 (ORNL-tr-1344)

**SOMESAN, M.**, Beam-plasma instability in the hollow cathode discharge, 20: 44937

**SOMOGYI, A.**, Production height of muons in EAS on basis of their geomagnetic deflection, 20: 44418

**SONA, P. G.**, Geometrical correlations in production and decays of elementary particles, 20: 44187

**SONIN, Ain A.**, Free-molecule Langmuir probe and its use in flowfield studies, 20: 44876

**SONNENBERG, K.**, Stored energy, volume, and resistivity change in neutron-irradiated Al, 20: 45037

**SONNI, K. S.**, Chromatographic separation of niobium and tantalum using amines, 20: 43446

**SOOD, P. C.**, Isospin potential term with local and nonlocal interactions, 20: 44691

**SOOD, P. C.**, Isospin potential term with local and non-local interactions, 20: 44844

**SOOD, P. C.**, Second order corrections to rotational spectra in deformed even even nuclei, 20: 44848

**SOONG, James C.**, Prog. rpt. on recrystallization and sintering of oxides, 9/65–8/66, 20: 43813 (COO-1122-3)

**SOROKINA, Yu. D.**, Pathological anatomy of radiation leukemia in mice, 20: 42867

**SORU, E.**, Effects of ribonuclease and deoxyribonuclease on glutamic acid and methionine uptake in Ehrlich's ascitic carcinoma tumoural cells, 20: 42728

**SOTIC, Obrad**, Standard graphite block, 20: 45060

**SOUTHERN, E. M.**, Radiation induced changes in polyamino acids, 20: 42826

**SOUZA SANTOS, Tharcisio D.**, Fabrication of $UO_2$ fuel-elements for the Re-Suco subcritical assembly, 20: 43872

**SOUZA SANTOS, Tharcisio D.**, Production of metallic uranium and thorium, 20: 43871

**SOWERBY, M. G.**, Revision of the Harwell $^{240}$Pu source strength and $\bar{\nu}$ for $^{235}$U and $^{252}$Cf, 20: 44594

**SOZOU, C.**, Field boundary of two line currents immersed in a streaming plasma, 20: 44912

**SPACU, P.**, Halogenomandelic acids, reagents for separation and determination of rare earths in presence of U(VI), 20: 43141

**SPACU, P.**, Salts of Dy with various organic acids, 20: 43140

**SPALLER, A. E.**, Structural analysis of shipping casks, 20: 43492 (ORNL-TM-1312(Vol.2))

**SPANGLER, G. W.**, Fast neutron weighting factors for manrated SNAP reactor applications, 20: 43580 (NAA-SR-Memo-11901)

**SPANN, J. R.**, High temperature PVT properties of Na, K, and CS, 20: 43944

**SPANN, J. R.**, High temperature vapor pressures of Na, K, and Cs, 20: 43945

**SPANN, J. R.**, High temperature specific volumes of liquid Na, K, and Cs, 20: 43946

**SPECCHIA, G.**, Modification of duration of physiologic activity of insulin subjected to labeling with $^{131}$I, 20: 42760

**SPECCHIA, G.**, Modification of biologic activity of labeled insulin, 20: 42761

**SPECTOR, Marshall L.,** Thermite process for the fixation of high level radioactive wastes, 20: 45226

**SPINK, Paulette,** Computer program for automatic decomposition of spectra from charged-particle reactions, 20: 44656 (TID-23315)

**SPITSYN, Vikt. I.,** Effects of radiation from $^{99}$Mo on surface structure of MoO$_3$, 20: 44026

**SPITSYN, Vikt. I.,** EPR spectra of irradiated frozen aqueous solutions. II., 20: 43309

**SPITSYN, Vikt. I.,** EPR spectra of irradiated frozen aqueous solutions. III., 20: 43310

**SPITZ, R.,** Deuterium isotope effect in reaction of tert-butoxy radicals with aliphatic ketones, 20: 43284

**SPITZIG, W. A.,** Dislocation arrangements in Ta single crystals deformed in tension at 373°K, 20: 43923

**SPOR, R. W.,** X-ray diffraction study of atomic ordering in two sigma phases, 20: 43890 (COO-1198-385)

**SPOREK, K. F.,** Argon-ionization, helium-electron capture detector for gas chromatography, 20: 43156

**SPORRE, Bert,** Latitude effect of the neutron multiplicity as detected by a shipborne neutron monitor, 20: 44423

**SPORRE, Bert,** Multiplicity measurements on the Uppsala IGY-neutron monitor, 20: 44424

**SPRAWLS, Perry, Jr.,** Critical organ exposure during fluoroscopy with analysis of contributing parameters, 20: 43050

**SREENIVASAN, N.,** Low-energy heavy nuclei of primary cosmic rays, 20: 44458

**SRINIVASAN, A. R.,** Photosynthesis of $^{14}$C labeled sugars, 20: 43402

**SRINIVASAN, B.,** Gamma radiolysis of Pu solutions in 0.8N sulfuric acid, 20: 43358

**SRINIVASAN, K. R.,** Fuel cycles in PHWR and CANDU type reactors, 20: 45105 (AEET-252)

**SRINIVASAN, K. R.,** Physics studies of prototype power reactor project, 20: 45104 (AEET-239)

**SRINIVASAN, Kamala,** Radiolysis of aqueous solutions, 20: 43357

**SRINIVASAN, S. C.,** Possible separation of U from Th in mixtures of UO$_2$–ThO$_2$ by chlorination, 20: 43443

**SRINIVASAN, S. K.,** Scattering phase shift in stochastic fields, 20: 44393

**SRIRAMAM, K.,** Titrimetric determination of V(IV) with Ce(IV) sulphate at room temperature using ferroin as indicator, 20: 43144

**SRIVASTAVA, K. D.,** Support insulators for high voltage apparatus in vacuum, 20: 44043 (RHEL-R-124)

**SRIVASTAVA, S. B.,** Radiation induced cis-trans isomerization of stilbene in hydrocarbon solution. I., 20: 43360

**SRIVASTAVA, S. N.,** Reagents for the qualitative analysis of Ce(III)–Ce(IV) mixtures, 20: 43122

**STACHOWICZ, Waclaw,** Primary processes in radiation chemistry as studied by mass spectrometry. VII., 20: 4335

**STADLER, B.,** Average charge of stripped heavy ions, 20: 44136

**STAHMAN, Kenneth J.,** Reduction and hydrofluorination of U concentrates by fluid bed techniques, 20: 43200

**STANCIULESCU, V.,** Study of $^{65}$Zn distribution in protein fractions of guinea-pig serum, 20: 42791

**STANFORD, J. L.,** Photoelectric and optical properties of Pt, Au, and Pd foils and Al and Ag films, 20: 44995 (ORNL-TM-1392)

**STANNARD, F. R.,** Symmetry of the time axis, 20: 44193

**STANNETT, Vivian,** Grafting to cellulose and its derivatives, 20: 43346

**STARK, R. W.,** Effects of $\gamma$ radiation on biology and behavior of adult IPS Confusus, 20: 42883

**STARKS, Ralph J.,** Prog. rpt. on purification and crystallization of amorphous B powder, annual, 7/65-6/66, 20: 43090 (TID-23342)

**STARNER, Keith E.,** Stagnation point Langmuir probe measurements in an Ar arc jet, 20: 44878

**STARODUBTSEV, S. V.,** Absorption properties of irradiated quartz, 20: 43302

**STAS, K. N.,** Monitoring U mine atmospheres for short-lived daughter products of Rn, 20: 43594 (AEC-tr-6763)

**STEBBINGS, R. F.,** Charge transfer reactions of nitric oxide with ions of O and N, 20: 44127

**STEELE, D. A.,** Surface effects of radiation on microelectronic devices. II., 20: 43752 (AD-635583)

**STEELE, L. E.,** Prog. rpt. on irradiation effects on reactor structural materials, 8–10/65, 20: 43997 (NRL-Memo-1663)

**STEEN, A. J.,** Gamma spectrometry of neutron-activated soils, 20: 43607

**STEFANOVIC, Vladeta,** Radiation damage in steel with medium and high carbon content, 20: 44006

**STEFFENS, R.,** Measurement and control devices of the loading installation (AVR), 20: 45140

**STEGLICH, Frank,** Superconductivity of double layers of Ag–Sn, 20: 44567

**STEHLIK, G.,** Pasteurization of fruit juices by irradiation, 20: 43787

**STEICHELE, E.,** Magnetic properties of the K = ½ rotational band of $^{171}$Yb, 20: 44753

**STEINBERG, M.,** Fission recoil synthesis, 20: 43300

**STEINDLER, M. J.,** Literature survey on properties of Te, its O and fluorine compounds, 20: 43164 (ANL-7142)

**STEINKULLER, E. W.,** High temperature PVT properties of Na, K, and CS, 20: 43944

**STEINKULLER, E. W.,** High temperature vapor pressures of Na, K, and Cs, 20: 43945

**STEINKULLER, E. W.,** High temperature specific volumes of liquid Na, K, and Cs, 20: 43946

**STENMAN, F.,** Self-contained system for stabilizing scintillation and semiconductor spectrometers, 20: 43712

**STENSLAND, B.,** Directional distribution of the cosmic-ray-meson component and solar activity, 20: 44422

**STEPANOV, K. N.,** Interaction between electromagnetic, plasma, and spin waves in antiferromagnetic semiconductors and metals, 20: 43982

**STEPANOVSKII, Yu. P.,** Six-dimensional form of Dirac matrix algebra, 20: 44387

**STEPHENS, D. R.,** Effect of pressure on temperature calibration of Mo/Mo-50 Re thermocouples, 20: 43636 (UCRL-14993)

**STEPHENS, Joseph R.,** Compatibility of Ta, Nb, and their alloys with H, 20: 43832 (NASA-TN-D-3546)

**STEPHENS, K. G.,** Closed-circuit television in nuclear industry, 20: 43472

**STEPIEN, Kazimierz,** Hydromagnetic oscillation of plasma, 20: 44950

**STERN, Marvin J.,** Absence of isotope effects in absence of force constant changes, 20: 43227

**STETTLER, J. D.,** Stress effects on 9572 cm$^{-1}$ line in irradiated MgO, 20: 45025

**STEUNENBERG, R. K.,** Preparation of $^{24}$Mg from $^{24}$MgO, 20: 44717

**STEUNENBERG, Robert K.,** Thermodynamics of dilute solutions of plutonium in liquid magnesium, 20: 43819

**STEVOVIC, Jelica,** Production of $^{131}$I, 20: 43404

**STEWART, D. T.,** Ionization loss by relativistic electrons, 20: 44232

**STEWART, D. T.,** Photomultiplier resolving time measurements utilizing a light pulse generator, 20: 43709

**STEWART, J. C. C.,** United Kingdom nuclear power program, 20: 45179

**STEWART, K. B.,** Sodium mass transfer. XIV., 20: 43826 (GEAP-4830)

**STIGALL, Garry E.,** Public health evaluation of nuclear power plants, 20: 43632

**STIHI, M.,** Jost functions, the Levinson theorem, and multichannel problems in relativistic theory of S matrix, 20: 44386

**STILES, D. A.,** Photolysis of Group VI hydrides. I., 20: 43196

**STILES, L. F. Jr.,** $F_2^+$ center in NaF, 20: 45029

**STINSON, W. H.,** Nuclear power-water desalting plant and the electric utility industry, 20: 45189

**STODDART, H. A.,** X-ray fluorescence analysis, 20: 43058 (AERE-Bib-136(Pt.2))

**STODDART, Hugh F.,** Apparatus and method for determination of fluid volume by radioactive dilution techniques, 20: 43054

**STOEHR, K. W.,** Compact Na-cooled nuclear reactor installation at Karlsruhe (KNK), 20: 45160

**STOICHEV, T.,** Ion resonance in weakly ionized gas, 20: 44889

**STOKINGER, Herbert E.,** Beryllium: its industrial hygiene aspects, 20: 43627

**STOKINGER, Herbert E.,** Recommended hygienic limits of exposure to Be, 20: 42755

**STOKLASOVA, Hana,** Effects of radiation doses on erythropoies of rats, 20: 42957

**STOLOFF, N. S.,** Survey of elevated temperature properties of niobium, 20: 43908 (PWAC-237)

**STONE, A. M.,** Wave interactions between plasma and electrons in magnetic field, 20: 44853 (AD-630040)

**STONE, J. P.,** High temperature PVT properties of Na, K, and CS, 20: 43944

**STONE, J. P.,** High temperature vapor pressures of Na, K, and Cs, 20: 43945

**STONE, J. P.,** High temperature specific volumes of liquid Na, K, and Cs, 20: 43946

**STONEHOUSE, A. J.,** Prog. rpt. on intermetallic compounds for very high-temperature applications, 4–6/61, 20: 43886 (BBC-111)

**STORM, D. W.,** Tests of time-reversal invariance in the reactions $^{24}\text{Mg} + d \rightleftarrows {}^{25}\text{Mg} + p$, 20: 44805

**STOUT, D. F.,** Soft electron spectrometer for auroral research, 20: 43667 (AD-639694)

**STRAATMANN, J. A.,** Lanthanum–La hydride phase system, 20: 43234

**STRAMBI, E.,** Medical controls of radiation exposure laboratories, 20: 43600

**STRASHEIM, A.,** Semiquantitative procedure for simultaneous spectrographic determination of elements in powder samples, 20: 43104

**STRATHDEE, J.,** Multiple field relations, 20: 44363

**STRAUSZ, O. P.,** Photolysis of Group VI hydrides. I., 20: 43196

**STREATER, R. F.,** Canonical quantization, 20: 44297

**STREIFLER-SHAVIT, I. E.,** Desalination today and tomorrow, 20: 45187

**STRELKOV, A. S.,** Wide-range detector of light pulses, 20: 43722

**STRELKOV, B. C.,** Thermal insulation of plasma in Tokamak, 20: 44873 (MATT-Trans-35)

**STRELKOV, R. B.**, Blood picture features in animals protected by cysteinamine from radiation, 20: 42982
**STRELKOV, R. B.**, Concentration of O in tissues during barbamyl anesthesia, 20: 43008
**STRNAT, Karl J.**, Rare earth Co compounds with the $A_2B_{17}$ structure, 20: 43920
**STROEMBERG, L. G.**, Multiple scattering of fast neutrons in $^{10}$B-glass scintillators, 20: 43700
**STROETZEL, M.**, Inelastic electron scattering from $^{16}$O and the radiative widths of the 6.9 and 11.5 Mev levels, 20: 44769
**STROIKIN, N. I.**, Determination of depth of barrier window in N-I-P structure, 20: 43742
**STROMBERG, H. D.**, Effect of pressure on temperature calibration of Mo/Mo-50 Re thermocouples, 20: 43636 (UCRL-14993)
**STRUGAL'SKII, Z. S.**, Radiative unit and critical energy in Xe, 20: 44642 (JINR-P-2808)
**STUERMER, W.**, Problems in the planning and construction of the AVR Research Nuclear Power Plant, 20: 45132
**STURROCK, P. A.**, Model of the high-energy phase of solar flares, 20: 44086
**STURROCK, P. A.**, Model of quasi-stellar radio sources, 20: 44087
**STURTEVANT, B.**, Magnetic mass spectrometer studies in impure shock-heated Ar, 20: 43123
**STUTZ, Ernst**, Effects of x radiation on growth of Yoshida Ascites sarcoma in rats, 20: 42962
**SUBBOTIN, V. I.**, Leakage discovery in Na–$H_2O$ steam generator, 20: 45059
**SUBLETT, T. H.**, Laboratory investigation of recovery processes for pitchblende residues, 20: 43420 (MCW-1508)
**SUBLETT, T. H.**, Production of thorium oxide for vibratory compaction by a modified sol-gel process, 20: 43850 (CONF-660524-15)
**SUBRAHMANYAN, R. V.**, Some features of geomagnetic sudden commencements following cosmic-ray flares, 20: 44466
**SUBRAMANIAN, T. A.**, Fuel cycles in PHWR and CANDU type reactors, 20: 45105 (AEET-252)
**SUDA, N.**, Some investigations into application of pseudo-random binary signals to reactor dynamics measurements, 20: 45213
**SUGAI, Etsuji**, Effect of temperature on radiation-induced male sterility in silkworm, 20: 42930
**SUGIMOTO, Daiichiro**, Second helium flash and an origin of carbon stars, 20: 44100
**SUHR, R. W.**, High frequency fatigue lite of some magnesium alloys used in fuel element applications, 20: 43957
**SUICH, John E.**, Sensitivity of $D_2O$ moderated reactor parameters to thermal neutron scattering law, 20: 45066 (CONF-660303, pp 151-70)
**SUIT, Herman D.**, Response to x-irradiation of a tumor that recurred following $TCD_{98}$ radiation dose, 20: 43035
**SUITA, Tokuo**, Mean electron energy of a plasma emerging from a duoplasmatron ion source, 20: 44921
**SUL'TANOV, M. A.**, Investigation of the interaction of supersonic torches in pulse discharge, 20: 44962
**SUMERLING, R.**, Formation of intergranular voids and cracks in an irradiated austenitic steel tensile-tested in the temperature range 650–850°C, 20: 44016
**SUMI, Yoshio**, Real amplitude in high energy elastic scattering, 20: 44384
**SUMITA, Kenji**, Measurement of space-dependent source transfer function using pulsed neutron source, 20: 45082
**SUMMERS, L.**, Effect of fast neutron irradiation on $C_{33}$ elastic modulus of graphite, 20: 44018
**SUNDARESAN, M.**, Determination of elemental C in liquid metal reactor coolants, 20: 43135
**SURIKOVA, K. K.**, Reactivity of spermatogenic epithelium in mice, 20: 42942
**SURIN, V. M.**, Application of autoradiography for control of irregularity of actinide element layers, 20: 43866
**SUSHCHINSKII, M. M.**, Intensity distribution in induced combinational scattering spectra, 20: 44148
**SUSZYCKI, L.**, Generation of the high-energy nucleon-electron cascade by means of the program written for the small computer, 20: 44152
**SUSZYCKI, L.**, Program for the interpolation of the cascade curves with the aid of a small electronic computer, 20: 44153
**SUTTON, Alan H.**, Reduction and hydrofluorination of U concentrates by fluid bed techniques, 29: 43200
**SUTTON, D. C.**, Photoproduction and $\beta$-decay of $^{6}$He, 20: 44726
**SUTTON, J.**, Origin of primary H atom yield in radiolysis of aqueous solutions, 20: 43351
**SUZDALEV, I. P.**, Nuclear $\gamma$ resonance on highly dispersive Sn, 20: 44149
**SUZUKI, Hamaji**, Observations of fallout in Tokyo. II., 20: 43518 (NSJ-tr-54)
**SUZUKI, Hisashi**, Variations in some properties of sintered WC–Co alloys with particle size and binder composition, 20: 43878
**SUZUKI, Kenji**, Quadruple correlation in the extra binding energy of the s-d shell nuclei, 20: 44818
**SUZUKI, Osamu**, Observations of fallout in Tokyo. II., 20: 43518 (NSJ-tr-54)
**SUZUKI, Shin**, Chemistry of Pa. II., 20: 43431
**SUZUKI, T.**, Anomalous attenuation of ultrasonic waves in superconducting niobium, 20: 44529
**SUZUKI, T.**, Peak effect in the magnetization of superconducting niobium, 20: 44528
**SUZUKI, Yasuo**, Echelle monochromator and application to ion temperature measurement of He plasma, 20: 44920
**SVETLOVA, L. S.**, Boiling potassium heat transfer in tube at moderate vapor content value, 20: 43485
**SVICEKOVA, Maria**, New complexans. VI., 20: 43204
**SVIDZINSKII, A. V.**, Electrodynamics of the Josephson effect, 20: 44571
**SVIDZINSKII, A. V.**, Theory of superconductor tunneling, 20: 44570
**SVYATUKHIN, M. V.**, Pathological anatomy of radiation leukemia in mice, 20: 42867
**SWANKS, J. H.**, In-place iodine filter testing, 20: 43584 (ORNL-P-2411)
**SWANSON, V. A.**, Cold neutron effects in graphite diffusion measurements, 20: 44585 (NAA-SR-Memo-11866)
**SWENSON, L. D.**, DOLTL: computer code to calculate temperature drift for statically controlled SNAP 10A type reactors, 20: 45198 (NAA-SR-Memo-11977)
**SWIFT-HOOK, Donald Thomas**, Improvements in or relating to magnetohydrodynamic apparatus, 20: 44172
**SYCHKOV, M. A.**, Relative biological effectiveness of high-energy protons affecting cabbage seeds, 20: 42898
**SYKES, A. G.**, Kinetics of the oxidation of Eu(II) with V(III) and Cr(III) in aqueous perchloric acid solutions, 20: 43228
**SYMONDS, J. L.**, Approach to the physics of thorium loaded beryllia moderated reactors, 20: 45176
**SYMONS, G. D.**, Determination of the gyromagnetic ratios of some odd-A deformed nuclei from branching ratio measurements, 20: 44791
**SYMONS, M. C. R.**, General correlation of E.S.R. data for F-centers, 20: 43350
**SYROMYATNIKOV, N. G.**, Distribution of Th isotopes between the particles of various degree of dispersion in natural waters, 20: 43535
**SYSOEVA, L. N.**, Study of the content of long-lived fission-fragment radionuclides in the Black Sea, 20: 45227
**SZAYKOWSKI, Andrzej**, Reaction of rat intestines to parasympathomimetic substance during radiation syndrome, 20: 42984
**SZPIKOWSKI, Stanislaw**, Pairing approximation for $p_{3/2}^{+}$ and $f_{7/2}^{-}$ nuclear shells, 20: 44684
**SZPIKOWSKI, Stanislaw**, Quasi-spin representations of the orthogonal group $R_5$, 20: 44676
**SZYMACHA, A.**, Problem of dynamical groups in quantum mechanics, 20: 44290
**SZYMACHA, A.**, $SU_3$ as a dynamical group of the Hamiltonian $H = \frac{1}{2} p^2 + V(r)$, 20: 44291

# T

**TABACHENKO, A. N.**, Analytic properties of the scattering amplitude in a theory involving a $g\phi^4$ Lagrangian, 20: 44396
**TABATA, Tatsuo**, Angular distribution of backscattered electrons and backscattering coefficient, 20: 44115
**TABATA, Tatsuo**, Anomalous secondary electron emission. I., 20: 44117
**TABATA, Tatsuo**, Energy distribution of backscattered electrons. II., 20: 44116
**TABATA, Tatsuo**, Fluorine-19 ($\gamma$,n) cross section from threshold to 14 Mev, 20: 44683
**TABORSKY, Jan**, Effects of radiation doses on erythropoies of rats, 20: 42957
**TACONIS, K. W.**, Oscillations in voltage between two weakly connected current-carrying superconductors, 20: 44561
**TADMOR, Jacob**, Theoretical evaluation of gas chromatographic isotopic exchange and column efficiency, 20: 43103
**TADMOR, N. H.**, Comparison of neutron moderation and gravimetric sampling for soil-moisture determination, 20: 43094
**TAGAKI, Waichiro**, Oxygen exchange reaction of phenol in acidic media, 20: 43276
**TAGLIAFERRI, G. L.**, Variations in relations of solar indices to E- and F-region character figures, 20: 44435
**TAKABAYASI, Takehiko**, Equation of motion of elementary particle from unified approach, 20: 44382
**TAKABAYASI, Takehiko**, Unified wave equation for elementary particles, 20: 44383
**TAKAHASHI, Hikaru**, Atomic bomb casualties who visited Hiroshima University psychiatric department, 20: 42924
**TAKAHASHI, Y.**, Generalized Ward identity and unified treatment of conservation laws, 20: 44320
**TAKAHASHI, Yasuo**, Determination of nitrogen in U nitrides by the Dumas and Kjeldahl methods, 20: 43109
**TAKAMI, Toshiko**, Activation of $TiO_2$ as a decontaminant for radioactive

contamination, 20: 43385
**TAKEDA, Keiji,** Electron spin resonance study of radiation-induced solid-state polymerization of conjugated dienes, 20: 43325
**TAKEI, Shinsuke,** Extraction of U(VI) with thenoyltrifluoroacetone-tri-n-octylamine mixture, 20: 43440
**TAKENAKA, Akira,** Universality of the strong interaction of hadrons, 20: 44375
**TAKETATSU, Tomitsugu,** Synergic solvent extraction of rare earths with mixtures of TTA-TOPO, 20: 43100
**TALBOT, J. W.,** Dilution, dispersion, and sedimentation in some British estuaries, 20: 45224
**TALESNIK, Jaime,** Influence of adrenal cortex on creatine excretion induced by irradiation in rat, 20: 42801
**TALHOUK, A. S.,** Prospects and needs for radiation disinfestation of packed fruits and vegetables, 20: 43780
**TALLER, E. G.,** Condenser batteries with 625-kJ stored energy for producing strong magnetic fields, 20: 43457
**TALMI, I.,** Nuclear energy levels of calcium isotopes, 20: 44762
**TAMAS, G.,** Deformation of the Ho nucleus, 20: 44710
**TAMPLIN, Arthur R.,** Estimation of dosage to thyroids of children in U. S. from nuclear tests in Nevada, 1952–55, 20: 43590 (UCRL-14707)
**TAMURA, Hitumi,** Plasma ion gun with Pierce electrode, 20: 44922
**TAMURA, T.,** Analogue state resonances in the $(p,p_0)$ and $(p,p')$ processes, 20: 44796
**TAMURA, Tsuneo,** Radioactivity in bottom sediments of the Clinch-Tennessee Rivers, 20: 45223
**TANAKA, Ryoichi,** Effect of radiation on the spermatozoa, 20: 42950
**TANIUTI, T.,** Magnetohydrodynamic stability and thermonuclear containment, 20: 44986
**TANNENBAUM, M.,** Anomalous magnetic moment of the negative muon, 20: 44207
**TANNER, James T.,** Determination of antimony in materials by neutron activation, 20: 43080 (ORO-2670-15)
**TANTON, G. A.,** Stress effects on 9572 $cm^{-1}$ line in irradiated MgO, 20: 45025
**TAQUIN, Jacques,** High-resolution NMR spectrograph, 20: 43685
**TARANTIN, N. I.,** Diffusion of nuclear reaction recoil in different materials, 20: 43073 (JINR-P-2804)
**TARAS, P.,** Properties of the 3.16-Mev level of $^{35}Cl$, 20: 44808
**TARASENKO, G. N.,** Thermomechanical treatment of the $\beta$ alloy of the Ti–Mo–Cr–Fe–Al system, 20: 43961
**TARASKO, M. Z.,** Fission fragments for fission of $^{235}U$ induced by thermal neutrons and 5, 6, and 7 Mev neutrons, 20: 44673 (LA-tr-66-36)
**TARRATS, A.,** Elastic scattering of polarized deuterons from $^{4}He$ between 18 and 22 Mev, 20: 44750
**TASHIRO, S.,** Effect of pH of solution on the contaminability by radioisotopes to skin, 20: 43010
**TASSI-PELATI, Laura,** Beta radioactivity in plankton from Adriatic and Ligurian-Tyrrhenian seas, 1961–1964, 20: 43536
**TATARA, Atsushi,** Effect of some chemical on rejoining of chromosome breaks. I., 20: 42913
**TATARU, S.,** Extraction of thorium by tributyl phosphate from nitric solutions, 20: 43450
**TATSUTA, Hatsumi,** Application of orthonormal expansion methods to neutron measurements. III., 20: 43694
**TAUB, J. M.,** Coated particle fuel elements for UHTREX, 20: 43855 (LA-DC-6954)
**TAUBENHEIM, J.,** Ionospheric absorption of short waves during solar eclipse February 15, 1961. V., 20: 44427
**TAUTH, Th.,** Transformation of the proton source of an U-120 cyclotron for negative H ion production, 20: 44056
**TAVARES COELHO, M. C.,** Radiostrontium in wet milk, tap-water, and rain water, 20: 42999 (NP-15934)
**TAYLOR, B. N.,** Experimental test of the Josephson frequency-voltage relation, 20: 44540
**TAYLOR, G. R.,** Chemical evaluation of Yankee Core I fuel cladding corrosion products, 20: 45126 (WCAP-6072)
**TAYLOR, H. A.,** Enriched uranium fuel cycles, 20: 45180
**TAYLOR, Hugh P. Jr.,** Oxygen isotope studies of Ivory Coast tektites and impactite glass from Bosumtwi Crater, Ghana, 20: 43511
**TAYLOR, J. C.,** Charge-current commutator contradicted by $\rho$-meson dominance, 20: 44360
**TAYLOR, J. G.,** Existence of field theory. I., 20: 44313
**TEITLER, S.,** Lorentz equivalence, unitary symmetry, and spin unitary symmetry, 20: 44315
**TEITLER, S.,** Structure of 4-spinors, 20: 44314
**TELEZHNIKOV, S. A.,** Differential cross section of $^{16}O(t,\alpha)^{15}N$ and $^{16}O(t,p)^{18}O$ reactions at energy range from 0.6 to 1.75 Mev, 20: 44641 (JINR-P-2796)
**TELLER, E.,** Monte Carlo study of a one-component plasma. I., 20: 44910
**TEMPERLEY, A. A.,** Electron-spin-resonance in fast-neutron-irradiated phosphorus-doped silicon, 20: 43986 (AD-637937)
**TENISHEVA, T. F.,** Infrared spectra of rare-earth pyrogermanates and structure of $Ge_2O_7$ anions, 20: 43218
**TENISHEVA, T. F.,** Infrared spectra and structure of rare-earth phosphates and sulfates, 20: 43219
**TEODOSIC, Vlado,** Resistivity of thin silver layers during heavy-ion irradiation, 20: 44004
**TERAO, Terumi,** Intersystem crossing of electronically excited dideuteroethylene molecules formed in benzene photosensitization, 20: 43197
**TERDIMAN, J. F.,** Procedure for calculation of gonadal x-ray dose in diagnostic radiography, 20: 43026
**TERENT'EV, I. V.,** Certain peculiarities of Schrodinger equation solutions for potentials with Coulomb tails, 20: 44283 (NP-16280)
**TERENTIEV, M. V.,** Ionization of atoms in a varying electric field. II., 20: 44151
**TERNOV, I. M.,** Theory of $\beta$-decay in the external magnetic field, 20: 44274
**TERRANI, M.,** New estimation of $^{144}Xe$ half-life, 20: 44706
**TERWILLIGER, K.,** $\pi^{+}p$ Elastic differential cross sections from 2.3 to 4.0 Bev/c, 20: 44248
**TESTARD, Olivier,** Cryogenic equipment, 20: 44501 (CEA-R-3008)
**TESTONI, J.,** Elastic scattering of polarized deuterons from $^{4}He$ between 18 and 22 Mev, 20: 44750
**TETYUKOV, V. D.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271
**TEUTSCH, H.,** Cold neutron scattering by liquid nitrogen, 20: 44598
**TEXTOR, R.,** Proton-recoil neutron spectrometry with organic scintillators, 20: 43672 (ORNL-P-2471)
**THATCHER, R. C.,** Experimental investigation of CP violation in $K_{2}^{0}$ decays, 20: 44259
**THATCHER, R. C.,** Test of time-reversal invariance in $K_{1}^{0} \to \pi^{-} + \mu^{+} + \nu$, 20: 44252
**THEIS, W. R.,** Electromagnetic form factors for arbitrary spin, 20: 44327
**THEISSEN, H.,** Nuclear charge radius difference for $^{48}Ti$–$^{50}Ti$, 20: 44789
**THIEBERGER, P.,** New pulse height compensator for time to amplitude converters, 20: 43651
**THIELE, R.,** Separation of the lanthanide elements and the actinides Am and Cm with amalgam cathode, 20: 43453
**THOMAS, G. E.,** Properties of partial radiation widths in $^{196}Pt$, 20: 44807
**THOMAS, K. T.,** Development of U-Foam air filters, 20: 43570 (AEET-244)
**THOMAS, K. T.,** Incineration of low-level radioactive solid wastes and gas cleaning, 20: 45214 (AEET-243)
**THOMAS, K. T.,** Separation and estimation of $^{228}Ra$ in Th plant effluent, 20: 43442
**THOMAS, K. T.,** Studies on Cs sorption properties of some Indian vermiculites, 20: 43130
**THOMAS, Lance,** Importance of photoionization in the production of the daytime F-region at high latitudes during winter, 20: 44467
**THOMAS, M. F.,** Low lying spin 1 state in $^{48}Ti$, 20: 44765
**THOMAS, R.,** Transition of fission products and actinides from irradiated oxides of U and Th in chloride and fluoride systems, 20: 43454
**THOMPSON, J. C. Jr.,** Dietary intake of radionuclides, 20: 43573 (CONF-765-13)
**THOMPSON, L. J.,** Dynamic penetration of selected projectiles into particulate media, 20: 45240 (SC-RR-66-376)
**THOMPSON, M. N.,** Photoproduction and $\beta$-decay of $^{8}He$, 20: 44726
**THOMPSON, T. J.,** Spatial distributions of fast neutrons in lattices of slightly enriched U rods moderated by $D_2O$, 20: 45077 (MIT-2344-5)
**THOMPSON, T. J.,** Use of neutron absorbers for the experimental determination of lattice parameters in subcritical assemblies, 20: 45078 (MIT-2344-6)
**THORNTON, S. T.,** Search for the trineutron, 20: 44650 (ORNL-P-2412)
**THORNTON, S. T.,** Search for the trineutron, 20: 44809
**THUEMMEL, H.-W.,** Determination of contents in ternary systems by measuring backscattering of secondary electrons and $\beta$-particles, 20: 43120
**THURSTON, Rodney S.,** Thermal-acoustic oscillations induced by forced convection heating of dense H, 20: 43480 (LA-3543)
**THURSTON, W. M.,** Determination of water in nonpolar liquids; solubility of water in benzene, 20: 43113
**TILLES, David,** Implantation in interplanetary dust of rare-gas ions from solar flares, 20: 44104
**TIMOFEEFF-RESSOVSKYA, N. A.,** Radiation genetics of Arabidopsis thaliana (L.) heynh. I., 20: 42900
**TIMROT, D. L.,** Thermal conductivity and degree of blackness of Nb at temperatures above 1000 C, 20: 43976
**TIRELLA, G.,** Modification of duration of physiologic activity of insulin subjected to labeling with $^{131}I$, 20: 42760
**TIRELLA, G.,** Modification of biologic activity of labeled insulin, 20: 42761
**TISCHER, P.,** Stored energy, volume, and resistivity change in neutron-irradiated Al, 20: 45037
**TITLE, R. S.,** $Cr^{3+}$ and rare earth doped $LiNbO_3$, 20: 43242
**TIXADOR, Rene,** Biological activity of natural ionizing radiations, 20: 42886

**TOBIAS, Cornelius A.**, Radiosensitivity of vestibular apparatus of rabbit, 20: 42858 (UCRL-16246, pp 74-83)

**TOBIN, J. M.**, Carbon diffusion in the carbides of niobium, 20: 43954

**TOCQUEVILLE, J.**, Production of isospin 1 resonances in the reaction $P + P = D + (\text{missing mass})$, 20: 44243

**TODORUT, Ioan**, New class of heteropoly compounds of octatungstocerates(IV). II., 20: 43253

**TOLLESTRUP, A. V.**, $\bar{p}p$ elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263

**TOLLIER, M. Th.**, Action of alpha and beta amylases on irradiated starch, 20: 42798 (NP-16224)

**TOLSTOY, I.**, Hydromagnetic gradient wave, 20: 44941

**TOLSTRUP, C. A.**, Structure within the R(1675) boson and possible structure within the $A_2(1290)$, 20: 44245

**TOMASHCHUK, Yu. F.**, Spark chambers for recording slow particles, 20: 43724

**TOMASHEVSKII, E. E.**, Using magnetic-field pulse modulation for recording original form of NMR and EPR spectra, 20: 43657

**TOMASINI, G.**, Structures in the 4 $\pi$ mass system in the reaction $\pi^- p \to p\pi^-\pi^+\pi^-\pi^0$ at 11 Bev/c, 20: 44241

**TOMITA, Toru**, Lead-alpha ages of some granitic rocks from North Kyushu and Central Japan, 20: 43556

**TOMONAGA, Sin-itiro**, Development of quantum electrodynamics, 20: 44494

**TONIOLO, D.**, Fluctuations in total neutron cross sections of Na, Al, Si, P, S in the energy interval from 5.0 to 8.5 Mev, 20: 44743

**TOPA, Jerzy**, Progress in reactor detectors design and construction, 1963–1965, 20: 43716

**TOPCHIYAN, L. M.**, Blood picture features in animals protected by cysteinamine from radiation, 20: 42982

**TORRE, Jean-Pierre**, High-resolution NMR spectrograph, 20: 43685

**TORRENS, I. McC.**, Fission fragment damage to crystal lattices: lead iodide. I., 20: 44023

**TORRENS, I. McC.**, Fission fragment damage to crystal lattices: lead iodide. II., 20: 44024

**TOSI, G.**, Electron beam depth dose measurements, 20: 43040

**TOUSCHEK, B.**, Transverse resistive-wall instability of extremely relativistic beams of electrons and positrons, 20: 44058

**TOWNLEY, Charles W.**, Chemical-equilibrium studies of organic-iodide formation under reactor-accident conditions, 20: 43166 (BMI-1781)

**TRAUTMANN, H.**, Experience with automatic deflector for Rossendorf cyclotron, 20: 44050

**TRAVNICEK, TOMAS**, Effects of radiation doses on erythropoies of rats, 20: 42957

**TREMEAU, O.**, Readiosensitization of yeasts by iodo-acetamide, 20: 42901

**TRENCH DE FREITAS, Clover**, Fabrication of $UO_2$ fuel-elements for the Re-Suco subcritical assembly, 20: 43872

**TRENCH DE FREITAS, Clover**, Production of metallic uranium and thorium, 20: 43871

**TRENTA, A.**, Results of radiotherapy of malignant lung tumors, 20: 43041

**TRET'YAKOVA, M. I.**, New method of investigating the mechanism of nuclear interactions, 20: 44192

**TRET'YAKOVA, M. I.**, Quasi-nucleon interactions between 24 Bev/c protons and nuclei of a photographic emulsion in a strong magnetic field, 20: 44280

**TRIBULEV, G. P.**, Biological studies carried out in satellites, 20: 42912

**TRICE, V. G. Jr.**, Cost study of processing of oxide, carbide, and metal fast-breeder-reactor fuels, 20: 43410 (ANL-7137)

**TRILLING, George H.**, Evidence for a K*(1320) resonance, 20: 44265

**TRILLING, George H.**, $K_2^0p$ interactions at low momentum, 20: 44250

**TRINCI, M.**, Clinical and radiotherapeutical investigation of metastases and cutaneous reappearances of neoplasia in female organs, 20: 43039

**TRINCI, M.**, Radiological and scintillation investigations of hepatitic compressions, 20: 43036

**TRIULZI, Cesare**, Beta radioactivity in plankton from Adriatic and Ligurian-Tyrrhenian seas, 1961–1964, 20: 43536

**TROFIMOV, V. I.**, Formation of radicals in the radiolysis of solid organic compounds. IV., 20: 43330

**TROISE, G.**, A measurement of the branching ratio $\omega \to \text{neutrals}/\omega \to \pi^+ + \pi^- + \pi^0$, 20: 44176 (LNF-66/31)

**TROJNAR, E.**, Transition temperature of superconducting Tc–Re alloys, 20: 44559

**TROLAN, J. K.**, Prog. rpt. on ultrafast moderate-energy pulse power system, 4/62–7/64, 20: 44850 (AD-628506)

**TRONCOSO, Oscar L.**, Prominent Forbush decreases and questionable magnetic disturbances, 20: 44420

**TRONCOSO, Oscar L.**, Storm sudden commencement and inconspicuous universal time variations of the cosmic ray intensity, 20: 44419

**TROUBETZKOY, E. S.**, Neutron cross sections of N, O, Al, Si, Fe, D, and Be, 20: 44661 (UNC-5139)

**TRUBATCH, J.**, Massive spin-two field, 20: 44295

**TRUBATCH, S.**, Massive spin-two field, 20: 44295

**TRUBCHANINOV, S. A.**, Interaction between plasmoids of a magnetic field of acute-angled geometry, 20: 44975

**TRUEBA BELLIDO, P.**, Building a power cell for the fuel handling machine for the DON Reactor, 20: 45163

**TRUEBA BELLIDO, P.**, Fuel handling system of the DON Reactor, 20: 45162

**TRUSKOVA, N. F.**, Charge distribution of particles in a one-meson theory of inelastic interactions at high energies, 20: 44183

**TRUTA, E.**, Study of $^{65}$Zn distribution in protein fractions of guinea-pig serum, 20: 42791

**TSALETKA, R.**, Chemical properties of element 104, 20: 43192

**TSCHIRNE, Georg**, Precipitation of uranium dioxide from alkali chloride melts, 20: 43185 (ZFK-WF-25)

**TSEVETAEV, A. A.**, Stress relaxation in uranium, 20: 43936

**TSIAO, Hui-yu**, Analysis of the $^{12}C(d,\alpha_0)^{10}B$ reaction, 20: 44826

**TSIONSKII, V. M.**, Kinetics of isotope exchange between gaseous H and H dissolved in Pd, 20: 43236

**TSIRLIN, Yu. A.**, Finding optimum conditions in radioactivation analysis of binary systems, 20: 43149

**TSUDA, N.**, Anomalous attenuation of ultrasonic waves in superconducting niobium, 20: 44529

**TSUDA, N.**, Peak effect in the magnetization of superconducting niobium, 20: 44528

**TSUKAMURA, Michio**, Effect of x-ray irradiation on fate of $^{35}$S-labeled vaccine in mouse, 20: 42907

**TSUKAMURA, Sumio**, Effect of x-ray irradiation on fate of $^{35}$S-labeled vaccine in mouse, 20: 42907

**TSUMORI, Kunihiko**, Anomalous secondary electron emission. I., 20: 44117

**TSUMORI, Kunihiko**, Fluorine-19 ($\gamma$,n) cross section from threshold to 14 Mev, 20: 44683

**TSVETKOV, O. S.**, Natural neutron background of the atmosphere and earth crust, 20: 43547

**TSYPIN, A. B.**, General radiation sensitivity of organisms, 20: 42849 (NP-16258)

**TUBIANA, Maurice**, Growth of cells from irradiated experimental fibrosarcoma of C3H mice, 20: 42888

**TUBIS, A.**, Absorption and scattering effects in peripheral interactions according to an exactly-soluble multichannel formalism, 20: 44348

**TUDOR, Lucia**, Radiolysis of acetylene in solution. IV., 20: 43341

**TULINOV, A. F.**, Use of semiconductor counters of type p-i-n for study of nuclear reactions, 20: 43741

**TUNIS, Mary Jane**, Bibliography on physical properties and phase diagrams of ten refractory oxides, 20: 43911 (UCRL-6262(Pt.1))

**TUPITSYN, I. F.**, Basic exchange H reaction of nitrous heterocycles in liquid ammonia, 20: 43216

**TURCOTTE, Donald L.**, Structure of Alfven shocks, 20: 44414

**TURCU, Gr.**, Cytochemical and cytospectrophotometric study of leukocytes in $^{32}$P irradiated rats. Vitamins as radioprotectors, 20: 42948

**TURETSKAYA, E. A.**, Luminescence spectra of organic solutions of uranyl solutions of uranyl salts at different stages of damping, 20: 43262

**TURGUNOV, M. B.**, Pathological anatomy of radiation leukemia in mice, 20: 42867

**TURGUNOV, M. T.**, Ultrastructures of thymus cells in mice suffering from radiation leukemia, 20: 42882

**TURKIN, A. D.**, Measurements of activity of radioactive gases by spherical ionization chamber, 20: 43106

**TURNER, B. R.**, Charge transfer reactions of nitric oxide with ions of O and N, 20: 44127

**TURNER, C. T.**, ESR study of free radicals formed by $\gamma$-irradiation of poly(ethylene terephthalate), 20: 43324

**TURNER, D. T.**, Radiation crosslinking of a trans-1,4-polyisoprene in liquid and solid states, 20: 43326

**TURNER, D. T.**, Radiation chemistry of polyethylene terephthalate, 20: 43378

**TURNER, Frederick B.**, Influences of thermonuclear cratering test on populations of lizards, 20: 42732

**TUROS, A.**, Electronic pulse multiplier for identification of charged particles, 20: 43670 (INR-693/I/PL)

**TUSHCHENKO, M. A.**, Extraction of rare-earth antipyrine-salicylate complexes by benzene and fluorometric determination of Tb, 20: 43256

**TVETER, A.**, Determination of the gyromagnetic ratios of some odd-A deformed nuclei from branching ratio measurements, 20: 44791

**TWIN, P. J.**, Low lying spin 1 state in $^{46}$Ti, 20: 44765

**TYE, R. P.**, Thermal conductivity of compacted powder carbons with U carbide, 20: 43929

**TYERMAN, W. J. R.**, Photolysis of Group VI hydrides. I., 20: 43196

**TYSHCHENKO, A. P.**, Electrolytic cell for radioactive isotopes, 20: 43395

**TZARA, C.**, Deformation of the Ho nucleus, 20: 44710

## U

**UCHIDA, Taijiro**, Echelle monochromator and application to ion temperature measurement of He plasma, 20: 44920

**UDZULASHVILI, G. A.,** Destruction of thin film superconductivity by current pulses, 20: 44511

**UEDA, Jitsuhiko,** Note on the tempering behavior of a Ti–9 wt % Ta alloy quenched from $\beta$ region, 20: 43979

**UEMURA, Teiji,** Calculations for $\gamma$-ray scattering in density gage, 20: 43647

**UENO, K.,** Studies on radiation-induced ionic polymerization. I., 20: 43308

**UENO, K.,** Studies on radiation-induced ionic polymerization. III., 20: 43338

**UENO, K.,** Studies on radiation-induced ionic polymerization. IV., 20: 43339

**UGGERHOEJ, E.,** Emission of positrons and electrons from $^{64}$Cu embedded in single crystals, 20: 45019

**UI, T.,** Primary x-ray analyzer. II., 20: 43161

**ULIU, Florea,** Polarization effects in the disintegration of $\mu^-$ mesons, 20: 44272

**UMANSKII, Ya. S.,** Peculiarities of atomic structure of Ta–Nb solid solution, 20: 43975

**UMEZAWA, H.,** Dynamical rearrangement of symmetries. III., 20: 44518

**UMEZAWA, H.,** Generalized Ward identity and unified treatment of conservation laws, 20: 44320

**UPSON, U. L.,** Ion-exchange separation of kilocurie quantities of high purity Pm, 20: 43411 (BNWL-SA-677)

**URBAN, Edward C. J.,** Experimental Be toxicology, 20: 42754

**URBAN, P.,** Radiative corrections to electroproduction of pions, 20: 44225

**URBANETS, Ya.,** Investigation of the decay scheme of $^{138*}$Pr, 20: 44643 (JINR-P-2819)

**URBANI, G.,** Subcooled nucleate boiling with organic coolants, 20: 43486

**URUSOVSKAJA, A. A.,** Hardening of NaCl single crystals by x rays, 20: 45005

**UTTER, Merton F.,** Pyruvate carboxylase. VI., 20: 42773

**UVAROV, O. V.,** Separation coefficients of $^{12}$C and $^{14}$C by equilibrium evaporation of methane, 20: 43093 (BNL-tr-84)

**UZLYUK, V. N.,** Automatic and nuclear radiation control of industrial processes, 20: 43789

## V

**VACLAVIK, J.,** Quasilinear theory of two-stream cyclotron instability of electron beams, 20: 44894

**VAIDA, Mihai,** Symmetry transformation of the Dirac field, 20: 44385

**VAIDYANATHAN, S.,** Kinetics of reduction of tetravalent Pu by $H_2O_2$ in perchloric acid solutions, 20: 43245

**VAISH, S. P.,** Annealing behavior of neutron-irradiated tris-dipyridyl Co(III) perchlorate in hydrated form, 20: 43366

**VAJDA, I.,** Ray proof slit mount for x-ray powder diffractometers, 20: 43661

**VAKHLAKOVA, T. V.,** Ferro-ferri-sulfate method of $\gamma$-radiation dosimetry in radiological experiment, 20: 43696

**VALADARES, Manuel,** Existence of satellite bands in the spectra of internal conversion electrons, 20: 44696

**VALERI, D.,** Subcooled nucleate boiling with organic coolants, 20: 43486

**VALIUNAS, Andrew,** Bibliography on nuclear safety, 20: 43666 (AD-623557)

**VALLEE, Annie,** Measurement of integral flux of fast neutrons by Geiger-Mueller counters with activable cathodes, 20: 43729

**VALLOIS, G.,** Quadrupole and octupole excitations of spherical even-even nuclei in the region of closed shells, 20: 44799

**VALLOIS, G.,** Second-order excitation in the inelastic scattering of $\alpha$ particles, 20: 44795

**VALLOIS, G.,** Spectroscopy of $^{208}$Pb by inelastic scattering of protons at 24.55 Mev, 20: 44772

**VALLOIS, G.,** Spectroscopy of $^{207}$Pb by inelastic scattering of 24.5-Mev protons, 20: 44801

**VAN ASBROECK, Ph.,** Influence of fabrication parameters on the quality of Pu–Fe fuel elements, 20: 43869

**VAN CLEVE, J. E. Jr.,** Remotely operated equipment for fabricating HFIR target elements, 20: 45204 (ORNL-P-2410)

**VAN DER BURG, M. G. J.,** Gravitational waves in general relativity. IX., 20: 44496

**VAN DER MEER, S.,** Anomalous magnetic moment of the negative muon, 20: 44207

**VAN DER MEUL, V. A.,** Continued immunological tolerance in mice, independent of antigen excess, 20: 42730

**VANDEVELDE, G.,** Remotely operated pipetting device, 20: 43077 (NP-16214)

**VAN DE WIELE, F.,** Properties of color centers in CsBr single crystals irradiated at liquid-He temperature, 20: 45036

**VAN DIJK, Th.,** Luminescence caused by proton impact with special reference to the lunar surface, 20: 44035

**VAN DYCK, O.,** Observation of x-rays from spark discharges in a spark chamber, 20: 43714

**VAN ELST, H. C.,** Prog. rpt. on embrittlement in irradiated steel, 4–6/66, 20: 43993 (EURAEC-1691)

**VAN GURP, G. J.,** Superconducting fluxline pinning by twin boundaries, 20: 44560

**VAN LEUVEN, P.,** Hartree-Fock type calculation of $^{12}$C, 20: 44779

**VAN NIFTRIK, G. J. C.,** Elastic electron scattering from lead and bismuth at 53 Mev, 20: 44771

**VAN NIFTRIK, G. J. C.,** Nuclear charge radius difference for $^{46}$Ti–$^{50}$Ti, 20: 44789

**VANOLI, F.,** A measurement of the branching ratio $\omega \rightarrow$ neutrals/$\omega \rightarrow \pi^+ + \pi^- + \pi^0$, 20: 44176 (LNF-66/31)

**VAN ORDSTRAND, Howard S.,** Medical management of Be workers, 20: 42756

**VAN OSDOL, J. H.,** DRUTES: code to calculate design points of an unmanned, direct-radiating, thermoelectric system, 20: 45195 (NAA-SR-Memo-11819)

**VAN ROSSUM, G. D. V.,** Effects of K, ouabain, and valinomycin on efflux of $^{24}$Na$^+$ and pyridine nucleotides of rat-liver, 20: 42759

**VAN ROSSUM, G. D. V.,** Measurements of $^{24}$Na$^+$ -efflux and pyridine nucleotides in slices of rat liver, 20: 42758

**VAN SABBEN, D.,** Magnetospheric currents, associated with the N-S asymmetry of $S_q$, 20: 44438

**VANSELOW, K.,** Irradiation of nerve fiber with soft x-rays, 20: 42868

**VAN SOMEREN, L.,** Prog. rpt. on vacuum foil-type insulation for radioisotope power systems, 5–7/66, 20: 43798 (ALO-3634-2)

**VANT-HULL, L. L.,** Normal Josephson junctions and quantum coherence, 20: 44551

**VAN VIJFEIJKEN, A. G.,** Analogies of the Ettingshausen- and Peltier effects in the mixed state of type II superconductors, 20: 44538

**VAN WAMELEN, Diana,** Semiquantitative procedure for simultaneous spectrographic determination of elements in powder samples, 20: 43104

**VAPAILLE, Andre,** Irradiation of N silicon with electrons at energies below 300 kev, 20: 45001

**VARFOLOMEEV, M. B.,** Rare earth perrhenates, 20: 43217

Varona, J. L. Lopez
*see Lopez Varona, J. L.*

**VARTAK, D. C.,** Apparatus for thermal conductivity determination of organic coolants used in nuclear reactors, 20: 43270 (AEET-245)

**VAS, K.,** Radiosensitivity of purified and crude pectic enzyme preparations, 20: 43785

**VASIL'EVA, E. K.,** Absorption properties of irradiated quartz, 20: 43302

**VASIL'EVA, E. V.,** Investigation of some properties of niobium alloys, 20: 43940

**VASUDEVAN, R.,** Scattering phase shift in stochastic fields, 20: 44393

**VASYUKEVICH, P. V.,** Approximate computation of the variation in the electric conductivity of a gas in a vortex magnetohydrodynamic flow, 20: 44412

**VAUGHAN, E. U.,** Perturbation theory in burnup calculations, 20: 45067 (CONF-660303, pp 259-69)

**VAUGHAN, R. W.,** Versatile high pressure Moessbauer apparatus, 20: 43732

**VAUGOYEAU, Henri,** System U–$UO_2$ above 1130°C, 20: 43931

**VAVILOV, V. S.,** Use of semiconductor counters of type p-i-n for study of nuclear reactions, 20: 43741

**VAZ, J. E.,** Thermoluminescence of calcite from high $\gamma$ radiation doses, 20: 43552

**VDOVENKO, M. E.,** Separation of rare-earth elements as thiocyanates by paper chromatography, 20: 43452

**VDOVENKO, V. M.,** Contamination of Atlantic Ocean by long-lived radionuclides 1963–1964, 20: 43540

**VEEVERS, K.,** Behavior of beryllium oxide-based dispersion fuels, 20: 44014

**VEGA, A.,** Synthesis of 4-aspartal-1 and 2-$^{14}$C, 20: 43273

**VELJKOVIC, Slobodanka R.,** Radiation damage in steel with medium and high carbon content, 20: 44006

**VENEZIANO, G.,** SU(6)$_W$ algebra at infinite momentum, its tensor charges, and electric dipoles, 20: 44358

**VENKATARAMAN, G.,** Neutron scattering from gaseous methane and ammonia, 20: 44599

**VENKATASETTY, H. V.,** Uranyl chloride complexes of pyrazine and substituted pyrazines, 20: 43243

**VENKATESWARLU, Ch.,** Chromatographic separation of niobium and tantalum using amines, 20: 43446

**VENKATESWARLU, K. S.,** Effect of radiation on catalytic behavior of transition metal oxides, 20: 43364

**VENKATESWARLU, K. S.,** Possible separation of U from Th in mixtures of $UO_2$–$ThO_2$ by chlorination, 20: 43443

**VERBINSKI, V. V.,** Proton-recoil neutron spectrometry with organic scintillators, 20: 43672 (ORNL-P-2471)

**VERDEYEN, J. T.,** Electronic recombination in He and Ar afterglow plasmas, 20: 44854 (AD-630074)

**VERGNES, M.,** Production and study of the isomers $^{179m}$Hf and $^{177m}$Yb, 20: 44709

**VERHEY, L. J.,** Experimental investigation of CP violation in $K_2^0$ decays, 20: 44259

**VERHEY, L. J.**, Test of time-reversal invariance in $K_{,0} \rightarrow \pi^- + \mu^+ + \nu$, 20: 44252

**VERHOEVEN, J. D.**, Electrotransport of C, N, and O in Th, 20: 43820

**VERKERK, Barend**, Method for electrolytic production of uranium dioxide crystals, 20: 43266

**VERMILYEA, D. A.**, Deformation of anodic oxide films, 20: 43949

**VERON, P.**, Counts of radiosources in the revised 3 C catalogue, 20: 44088

**VERRI, Alessandro**, Waste processing plant of Rospo and Inspra-2 reactors, 20: 45220

**VETTER, H.**, Calibration and standardization of thyroid radioiodine uptake measurements, 20: 43031

**VEYSSIERE, M.**, Properties of collision and combustion waves and possibilities of their application to energy conversion, 20: 44174

**VIGIER, P.**, Point defects by neutron bombardment in iron containing impurities, 20: 45039

**VILANOVE, Roger**, Effect of crystalline environment on energy loss of electrons traversing a crystal, 20: 45003

**VILCOV, N.**, Nuclear radiation detectors based on semiconductor devices. IV., 20: 43739

**VINNICHENKO, A. E.**, Coherent bremsstrahlung radiation of 15-Mev electrons in a silicon monocrystal, 20: 45020

**VINOGRADOV, A. V.**, The excitation of atoms by neutral particles, 20: 44146

**VINOGRADOVA, N. V.**, Infrared spectra of rare-earth pyrogermanates and structure of $Ge_2O_7$ anions, 20: 43218

**VIRMANI, Y. P.**, Effect of radiation on catalytic behavior of transition metal oxides, 20: 43364

**VISHNEVETSKAYA, E. M.**, Problems of experimental and clinical radiobiology, 20: 42796

**VISINESCU, M.**, Jost functions, the Levinson theorem, and multichannel problems in relativistic theory of S matrix, 20: 44386

**VISSERS, D. R.**, Literature survey on properties of Te, its O and fluorine compounds, 20: 43164 (ANL-7142)

**VISWANATHAN, K. V.**, Photosynthesis of $^{14}C$ labeled sugars, 20: 43402

**VITERBO, Francesco**, Mucoprotein urine in radiation injuries. I., 20: 42960

**VLADIMIROV, Yu. A.**, Phosphorescence of proteins and aromatic amino acids subjected to uv radiation, 20: 42803

**VLASOV, N. A.**, Antimatter, 20: 44282

**VOGEL, H.**, International symposium on luminescence. Physics and chemistry of scintillators, Munich, 9/65, 20: 45044

**VOGEL, P.**, Energies of the octupole states of even-even nuclei in the energy region $228 \leqq A \leqq 254$, 20: 44751

**VOGEL, R. S.**, Simultaneous determination of Ca, Li, and K in high-purity $ThO_2$, 20: 43105

**VOGT, O.**, Magnetic transitions in EuSe, 20: 44523

**VOHR, J. H.**, Flow phenomena in feeding region of an externally pressurized gas bearing, 20: 43469 (TID-23350)

**VOLKOLUPOV, Yu. Ya.**, Confinement of charged particles pulse-injected into a trap with stationary fields, 20: 44972

**VOLODKO, L. V.**, Infrared absorption spectrum of monocrystals of sodium uranyl acetate, 20: 43285

**VOLODKO, L. V.**, Luminescence spectra of organic solutions of uranyl salts at different stages of damping, 20: 43262

**VOLYNKIN, Yu. M.**, Radiation protection during the flight in satellites "Voskhod I" and "Voskhod II", 20: 44990

**VOLZ, W.**, Coolant blower (AVR), 20: 45141

**VON ARDENNE, M.**, Alteration of organic lacquer films by electron irradiation, 20: 43353

**VON BRENTANO, P.**, Structure of the first three excited states in $^{208}Pb$, 20: 44787

**VON BRENTANO, P.**, Test of time-reversal invariance in the reactions $^{24}Mg(\alpha,p)^{27}Al$ and $^{27}Al(p,\alpha)^{24}Mg$, 20: 44793

**VON DER DECKEN, C. B.**, Experiments with installation parts (AVR), 20: 45146

**VON DIEMAR, Burkhard**, Gas permeability of skin under different conditions, 20: 42790

**VON JAN, R.**, Interpretation of recovery stages in irradiated metals, 20: 45040

**VON OERTZEN, W.**, Diffraction model interpretation of heavy-ion induced transfer reactions, 20: 44757

**VON WITSCH, W.**, Test of time-reversal invariance in the reactions $^{24}Mg(\alpha,p)^{27}Al$ and $^{27}Al(p,\alpha)^{24}Mg$, 20: 44793

**VOROB'EV, O. Ya.**, Concentration of O in tissues during barbamyl anesthesia, 20: 43008

**VOROB'EV, V. V.**, Crystal structure of Tb at 120 to 300°K, 20: 45043

**VOROB'EVA, V. G.**, Fission fragments for fission of $^{235}U$ induced by thermal neutrons and 5, 6, and 7 Mev neutrons, 20: 44673 (LA-tr-66-36)

**VOROZHEIKINA, L. F.**, Influence of structural dislocations on mechanical properties of irradiated crystals, 20: 43304

**VORWALD, Arthur J.**, Experimental Be toxicology, 20: 42754

**VORWALD, Arthur J.**, History of Be disease, 20: 42751

**VORWALD, Arthur J.**, Medical aspects of Be disease, 20: 42753

**VOSKRESENSKII, V. Yu.**, Thermal conductivity and degree of blackness of Nb at temperatures above 1000 C, 20: 43976

**VRZAL, Ya.**, Investigation of the decay scheme of $^{138*}Pr$, 20: 44643 (JINR-P-2819)

**VUKMIROVIC, Vojislav**, Application of radioactive tracers in study of sand movements in rivers, 12/65, 20: 43549 (NP-16200)

**VULIS, L. A.**, Hysteresis phenomena during the flow of a conducting gas in an MHD energy converter channel, 20: 44411

**VYHNANEK, Lubos**, Metabolism in epi- and metaphysis after local x irradiation. VIII., 20: 42785

W

**WADACHI, Y.**, Effect of pH of solution on the contaminability by radioisotopes to skin, 20: 43010

**WADDELL, C. N.**, Effect of Z = 28 shell closure on proton total reaction cross sections, 20: 44662 (USC-136-111)

**WAGNER, F.**, Magnetic properties of the K = ½ rotational band of $^{171}Yb$, 20: 44753

**WAGNER, F.-W.**, Continuous gamma-ray control of hot rolled ingots before cutting, 20: 43870

**WAGNER, Herbert**, Long-wavelength excitations and the Goldstone theorem in many-particle systems with "broken symmetries", 20: 45042

**WAGNER, P.**, Analysis of the reactions $^{25}Mg(p,p)^{25}Mg$ and $^{24}Mg(d,p)^{25}Mg$ at 5 and 6 Mev, 20: 44737

**WAGNER, P.**, Fluctuations of the cross sections of the reactions $^{25}Mg(p,p)^{25}Mg$ and $^{24}Mg(d,p)^{25}Mg$, 20: 44738

**WAGNER, P.**, Thermal conductivity of ZTA graphite, 20: 43896 (LA-DC-8163)

**WAINIO, K. M.**, Calculated gamma ray response characteristics of semiconductor detectors, 20: 43701

**WALCZAK, Wlodzimierz**, Inactivation of solutions transforming DNA with aid of $\gamma$ radiation, 20: 42818

**WALECKA, J. D.**, Electron scattering and nuclear structure, 20: 44679

**WALECKA, J. D.**, Some observations concerning the supermultiplet of negative-parity excited states in the $\alpha$ particle, 20: 44755

**WALEK, W. J.**, Prog. rpt. on emissivity of materials, semiannual, 11/65–5/66, 20: 43816 (PWA-2877)

**WALEN, Robert J.**, Existence of satellite bands in the spectra of internal conversion electrons, 20: 44696

**WALES, W.**, Observation of x-rays from spark discharges in a spark chamber, 20: 43714

**WALKER, D. C. B.**, Effect of fast neutron irradiation on $C_{33}$ elastic modulus of graphite, 20: 44018

**WALKER, W. H.**, Cross sections and resonance integrals for the neutron activation of $^{103}Rh$, 20: 44689

**WALLACE, W. E.**, Magnetic characteristics of some lanthanide nitrides, 20: 43939

**WALLER, George R.**, Mass spectrometry of biosynthetically labeled ricinine, 20: 43382

**WALLER, I.**, Derivation of van Hove-Glauber formula, 20: 44593

**WALLIS, G.**, Continuous thermal radio emission of a plasma layer in the region of the plasma frequency, 20: 44883

**WANG, Chuan**, Radiation for automatically controlling level of liquid metal in crystallizer when steel is cast, 20: 43761

**WANG, Fan**, Analysis of the $^{12}C(d,\alpha_0)^{10}B$ reaction, 20: 44826

**WANG, Frederick E.**, Crystal structures of $LuMn_5$ and the $RMn_{12}$ compounds (where R = Gd, Tb, Dy, Ho, Er, and Tm), 20: 43918

**WARCZEWSKI, J.**, Generation of the high-energy nucleon-electron cascade by means of the program written for the small computer, 20: 44152

**WARCZEWSKI, J.**, Program for the interpolation of the cascade curves with the aid of a small electronic computer, 20: 44153

**WARING, J. L.**, Phase equilibria and crystal structure in $Nb_2O_5$–$WO_3$, 20: 45012

**WARTBURG, A. V.**, Tritium-labeled cardiac glycosides, 20: 42722

**WARTERS, Mary**, Prog. rpt. on X-autosomal translocations of Drosophila melanogaster, final, 1966, 20: 42709 (TID-23233)

**WASSERMAN, I.**, Infrared absorption spectrum of $^{18}O$-labeled glycine, 20: 43283

**WASSERMAN, R. H.**, Radioisotopes in veterinary medicine, 20: 42723

**WATANABE, Masanori**, Mean electron energy of a plasma emerging from a duoplasmatron ion source, 20: 44921

**WATANABE, T.**, Fission cross section of $^{241}Pu$ from 0.01 ev to 0.5 ev, 20: 44635 (IN-1012)

**WATANABE, Tsutomu**, Structural model of the hydrated electron, 20: 43322

**WATSON, C. E.**, Test of the microscopic theory of the nuclear gamma vibration, 20: 44797

**WATSON, Paul D.**, Fabrication and installation of LACBWR reactor piping system, 20: 45119 (SWRI-1228-7-34)

**WATSON, R. D.**, Wear and corrosion in water, 20: 43823 (AECL-2566)

**WATTENBERG, A.**, Experimental investigation of CP violation in $K_{2}^{0}$ decays, 20: 44259

**WATTENBERG, A.**, Test of time-reversal invariance in $K_{1\,0} \rightarrow \pi^- + \mu^+ + \nu$, 20: 44252
**WATTS, C.**, Effect of therapeutic radiation on serum and urine $\beta$-glucuronidase, 20: 43025
**WAUGH, A. F.**, Alice machine tape-recorder data acquisition system, 20: 43638 (UCRL-70018)
**WAY, Stewart**, Magnetohydrodynamic generating duct, 20: 44171
**WAYNE, Ralph**, Radioprotective action of iproniazid, 20: 42991
**WEAVER, Charles L.**, Public health evaluation of nuclear power plants, 20: 43632
**WEBER, C. W.**, Comparative condensation pressure analyzer for uranium hexafluoride purity, 20: 43101
**WEBER, G.**, Small-angle electron-proton elastic-scattering cross sections for squared momentum transfers between 10 and 105 $F^{-2}$, 20: 44253
**WEBER, T.**, Analytic properties of resolvents and completeness, 20: 44707
**WEENS, H. S.**, Critical organ exposure during fluoroscopy with analysis of contributing parameters, 20: 43050
**WEETON, John W.**, Structure and properties of tungsten-base powder metallurgy composites, 20: 43899 (NASA-TN-D-3610)
**WEGENER, F. W.**, Coolant blower (AVR), 20: 45141
**WEI, C. T.**, Prog. rpt. on growth and properties of metal and compound single crystals, final, 6/61–6/66, 20: 43910 (TID-23269)
**WEI, Pao-wen**, Measurement of inelastic scattering cross section of Al by 2.52-Bev neutron, 20: 44828
**WEIHRAUCH, J.**, Average charge of stripped heavy ions, 20: 44136
**WEILL, Jacky**, Method of biological and medical exploration: ionography calibrated in roentgens, 20: 43028
**WEINBERG, Steven**, Pion scattering lengths, 20: 44256
**WEINER, Daniel E.**, Kinetics of distribution of $D_2O$ in canine intestinal tissues, 20: 42748
**WEINLEIN, W.**, Helium purification installation (AVR), 20: 45142
**WEIR, J. R.**, Solutions to the problems of high-temperature irradiation embrittlement, 20: 43999 (ORNL-TM-1544)
**WEISHAAR, Julius**, Dose distribution by use of different filter elements in cones, 20: 43047
**WEISS, E.**, Prog. rpt. on pulsating burnout, final, 3/66, 20: 43478 (EURAEC-1620)
**WEISSBACH, Arthur**, Formation of circular DNA after lysogenic induction, 20: 42721
**WEITKAMP, W. G.**, Tests of time-reversal invariance in the reactions $^{24}Mg + d \rightleftarrows {}^{25}Mg + p$, 20: 44805
**WELCH, G. A.**, Study of Pu(III)–sulfate complexes, 20: 43244
**WELLS, H.**, Radioactive decontamination by ultrasonics, 20: 43623
**WENG, Cheng-Wen**, Paper chromatographic study on distribution of product formed from $Ph_3(RaD)I$ after $\beta$-disintegration, 20: 43406
**WENZL, H.**, Stored energy, volume, and resistivity change in neutron-irradiated Al, 20: 45037
**WERLE, J.**, Problem of dynamical groups in quantum mechanics, 20: 44290
**WERNECKE, A. H.**, Shipper-receiver differences involving U compounds above five percent $^{235}U$, 20: 43065 (GAT-T-1403)
**WERNER, L.**, Helium purification installation (AVR), 20: 45142
**WESTERN, G. T.**, 14-Mev differential cross section of $^{93}Nb$, 20: 44615 (CONF-660303, pp 675-81)
**WESTPHAL, D.**, Problems of treating and testing fuel elements with regard to the power increase of the Rossendorf Experimental Reactor, 20: 45210
**WEYERS, J.**, Current commutation relations and meson photoproduction near threshold, 20: 44211
**WEYMANN, Helmut D.**, Prog. rpt. on electron and ion density of air shock waves, final, 10/64–11/65, 20: 44403 (AD-628143)
**WHARTON, Lennard**, Alternate-gradient focusing of molecular beams, 20: 44120
**WHEELWRIGHT, E. J.**, Ion-exchange separation of kilocurie quantities of high purity Pm, 20: 43411 (BNWL-SA-677)
**WHELAN, M. J.**, Measurements of extinction distance and absorption of high-energy electrons in crystals, 20: 45014
**WHITE, J.**, Equilibrium relationships in the system $CuO–Cu_2O–ZrO_2$, 20: 43978
**WHITE, John Michael**, Reaction of monoenergetic deuterium atoms with hydrogen molecules, 20: 43289 (CALT-532-2)
**WHITE, R. W.**, Sensitive detection of superconductivity by changes in inductance and losses of a resonant bridge, 20: 44508
**WHITEFIELD, J. F.**, Roles of phosphate and respiration in nuclear damage in irradiated rat thymocytes, 20: 42928
**WHITEHEAD, J. D.**, Sporadic E at night, 20: 44470
**WHITEHEAD, R. R.**, Measurement and analysis of high energy gamma-ray spectra, 20: 43702
**WHITESIDES, G. E.**, Adjoint Monte Carlo calculations for enriched U metal assemblies, 20: 45076 (K-DP-1637)
**WHITFIELD, J. F.**, Prevention of nuclear damage in irradiated rat thymocytes by deprivation, 20: 42989
**WHITMAN, A. M.**, Stagnation pressure measurement in a current-carrying plasma, 20: 44879
**WHITTEM, R. N.**, Condensed tables for x-ray fluorescence analysis, 20: 43057 (AAEC-TM-321)
**WIBLE, A. E.**, Recovery of $^{233}U$ from irradiated thoria, 20: 43415 (ISO-SA-3(Rev.))
**WICHNER, R. P.**, Theoretical slip ratios in annular two-phase flow, 20: 43482 (ORNL-TM-1519)
**WICKERSHAM, A. F. Jr.**, Identification of acoustic-gravity wave modes, 20: 44448
**WIDDER, F.**, Radiative corrections to electroproduction of pions, 20: 44225
**WIDEROEE, R.**, High-energy electron therapy and two-component theory of radiation, 20: 43018
**WIFFEN, F. W.**, Stage I recovery of pure Ag and the correspondence with Cu, 20: 44022
**WIFFEN, R. D.**, Counting, sizing, and sampling of Aitken nuclei in gas-cooled reactors, 20: 45055
**WIKHAMMER, G. A.**, Improved sheathed electric heater, 20: 43465 (AECL-2592)
**WILCOCK, John L. Jr.**, Prog. rpt. on recrystallization and sintering of oxides, 9/65–8/66, 20: 43813 (COO-1122-3)
**WILENSKY, S.**, Measurement of nonelastic cross section for Pb at 2.1 and 1.7 Mev, 20: 44618 (CONF-660303, pp 726-34)
**WILHJELM, P.**, Isobaric analogue states from proton excitation of medium-weight even nuclei, 20: 44761
**WILKIE, D.**, Heat transfer from roughened surfaces to a gaseous coolant. I., 20: 43487
**WILKIE, D.**, Some studies of heat transfer from roughed surfaces to a gaseous coolant. II., 20: 43488
**WILKINSON, K. J. R.**, Prospect of employing conductors at low temperature in power cables and in power transformers, 20: 44562
**WILLARD, H. B.**, Search for the trineutron, 20: 44809
**WILLARD, H. B.**, Search for the trineutron, 20: 44650 (ORNL-P-2412)
**WILLIAMS, D.**, $\pi^+p$ Elastic differential cross sections from 2.3 to 4.0 Bev/c, 20: 44248
**WILLIAMS, D. D.**, High temperature PVT properties of Na, K, and CS, 20: 43944
**WILLIAMS, D. D.**, High temperature vapor pressures of Na, K, and Cs, 20: 43945
**WILLIAMS, D. D.**, High temperature specific volumes of liquid Na, K, and Cs, 20: 43946
**WILLIAMS, Ffrancon**, Radiation-induced cationic polymerization, 20: 43292 (ORO-2968-21)
**WILLIAMS, J. F.**, Cross sections for double electron capture by 2- to 50-kev protons, 20: 44140
**WILLIAMS, J. R.**, 14-Mev differential cross section of $^{93}Nb$, 20: 44615 (CONF-660303, pp 675-81)
**WILLIAMS, James B.**, Apparatus and method for determination of fluid volume by radioactive dilution techniques, 20: 43054
**WILLIAMS, K. C.**, Organometallic exchange reactions. II., 20: 43392
**WILLIAMS, M. M. R.**, Note on the evaluation of $(v\Sigma_s)_{min}$ for the effective width model, 20: 44595
**WILLIAMS, R. F.**, Forming techniques for Be alloys, 20: 43856 (NASA-TM-X-53453(Vol.2))
**WILLIAMS, R. F.**, Joining techniques for Be alloys, 20: 43859 (NASA-TM-X-53453(Vol.6))
**WILLIAMS, R. F.**, Surface treatments for Be alloys, 20: 43857 (NASA-TM-X-53453(Vol.4))
**WILLIAMS, R. F.**, Thermal treatments for Be alloys, 20: 43858 (NASA-TM-X-53453(Vol.5))
**WILLIAMSON, A. N.**, Laboratory investigations of $\gamma$-ray spectral region for remote determination of soil trafficability conditions, 20: 43542
**WILLMARTH, T. E.**, Examination of praseodymium and europium hydroxide sols by electron microscopy and electron diffraction, 20: 43181 (ORNL-P-2439)
**WILMORE, D.**, Analysis of the reactions $^{25}Mg(p,p)^{25}Mg$ and $^{24}Mg(d,p)^{25}Mg$ at 5 and 6 Mev, 20: 44737
**WILNER, M.**, Role of causality in quantum field theory and the dynamical postulate, 20: 44317
**WILSON, J. R.**, Power plant cycles for dual-purpose plant applications, 20: 45188
**WINAND, L.**, Particles of abnormally long path emitted by $^{210}Po$, 20: 44686
**WINCEL, Henryk**, Primary processes in radiation chemistry as studied by mass spectrometry. VII., 20: 43335
**WINCHELL, H. Saul**, Classification and evolution of patterns of erythropoiesis in polycythemia vera, 20: 43015 (UCRL-16246, pp 1-18)
**WINCHELL, H. Saul**, Differential cytologic effects of negative pion beams in plateau and "star" regions, 20: 42859 (UCRL-16246, pp 100-2)
**WINHOLD, E. J.**, Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)
**WINKLER III, Joseph A.**, Effects of $^{60}Co$ irradiation of Euglena gracilis $(K_1)$, 20: 42906
**WINSON, R. W.**, UPSTART digital computer call program, 20: 45196 (NAA-SR-Memo-11894)

**WIRP, A.**, PERT planning in the Gundremmingen Atomic Power Plant, 20: 45161

**WIRTH, J. L.**, Anomalous photocurrent generation in transistor structures, 20: 43755 (SC-DC-66-1821)

**WITT, F. J.**, ADDENDUM: influence of cross-sectional shape on irradiation-induced stresses in graphite columns, 20: 44000 (ORNL-TM-1574)

**WITT, F. J.**, Comparison of theoretical and experimental results from spherical shells with a single radially attached nozzle, 20: 43491 (ORNL-P-2472)

**WITT, F. J.**, Stresses at nozzles in spherical shells loaded with pressure, moment or thrust, 20: 43467 (TID-23343)

**WITTCHOW, G.**, Characteristics of the structural plant (AVR), 20: 45134

**WITTENBERG, L. J.**, Liquid Pu: a review of its unusual properties, 20: 43889 (CONF-660606-39)

**WLODARSKI, Rafal**, Investigations on the obtaining of spherical uranium dicarbide particles from uranium dioxide, 20: 43876

**WOBIG, Horst**, Equilibrium and stability of a plasma with surface currents, 20: 44859 (IPP-6/53)

**WOELFLI, W.**, Direct determination of a short nuclear lifetime ($\approx 10^{-20}$s) by the proximity scattering method, 20: 44731

**WOHLER, J.**, Safety questions and safety devices (AVR), 20: 45143

**WOHLLEBEN, D.**, Detection of magnetic microstructures with charged particles, 20: 44039

**WOLF, James S.**, Method of inducing specific lymphopenia in dogs, 20: 42902

**WOLF, Richard A.**, Some effects of the strong interactions on the properties of neutron-star matter, 20: 44074

**WOLFRAM, B.**, Safety questions and safety devices (AVR), 20: 45143

**WOLFSBERG, K.**, Thermal neutron-induced fission cross section of $^{242m}$Am, 20: 44708

**WOLLENBERG, Harold A.**, Radioactivity of cement raw materials, 20: 43514 (UCRL-16878)

**WONG, A. Y.**, Observation of cyclotron echoes from a highly ionized plasma, 20: 44936

**WOOD, D. L.**, Effects of γ radiation on biology and behavior of adult IPS Confusus, 20: 42883

**WOOD, R. A.**, Gamma spectrometry of neutron-activated soils, 20: 43607

**WOOD, R. M.**, Continuous neutron spectra from (p,n) reactions, 20: 44739

**WOODMAN, Margaret J.**, Thermal conductivity of compacted powder carbons with U carbide, 20: 43929

**WOODRUFF, Gene L.**, Spatial distributions of fast neutrons in lattices of slightly enriched U rods moderated by $D_2O$, 20: 45077 (MIT-2344-5)

**WOODS, J. J.**, Neutron decay spectrometer, 20: 43745

**WOODWARD, R. N.**, Studies in radioactive fallout in New Zealand. III., 20: 43530

**WOOLEY, J. A.**, Thermodynamic functions of nuclear materials: UC, $UC_2$, $UO_2$, $ThO_2$, and UN, 20: 43907 (ORNL-TM-1596)

**WORDEN, J. R.**, Sensitivity of thermal reactor parameters to scattering model, 20: 45065 (CONF-660303, pp 146-50)

**WORLTON, William J.**, Administration of secondary storage in nuclear codes, 20: 43804 (LA-3546)

**WORSNOP, B. R.**, Use of lithium fluoride dosimeters for in vivo measurement of transmission through bone and lung, 20: 43747

**WRAY, J. G.**, Ordering theorems, 20: 44311

**WRIGHT, John Keith**, Improvements in or relating to magnetohydrodynamic apparatus, 20: 44172

**WU, C. S.**, Quadrupole moment of the first excited state of spherical nuclei, 20: 44812

**WU, Chi-Lan**, Paper chromatographic study on distribution of product formed from $Ph_3(RaD)I$ after β-disintegration, 20: 43406

**WU, Mei-chen**, Measurement of inelastic scattering cross section of Al by 2.52-Bev neutron, 20: 44828

**WUCKEL, L.**, Experience on a 2 Mev Van de Graaff accelerator in radiation-chemical works, 20: 43328

**WUERTHNER, K.**, Reduction of radiation burden of patient treated by high-energy radiation. I., 20: 43012 (BMwF-FBK-66-03)

**WUSTNER, R.**, Breeder reactor development in France, 20: 45157

# Y

**YABE, A.**, Ingestion, excretion, and accumulation on fallout $^{137}$Cs in man, 20: 42794

**YABUKI, Haruichi**, Multichannel scattering and equivalence between four-fermion and Yukawa coupling, 20: 44377

**YADROVSKII, E. L.**, (γ,p) and (γ,n) reactions mechanism in the medium and heavy nuclei region, 20: 44778

**YADROVSKII, E. L.**, Nucleon widths of isobaric analogue states in nuclei, 20: 44777

**YAJIMA, Nobuo**, Effect of finite ion Larmor radius on the propagation of magnetoacoustic waves, 20: 44952

**YAKHYAEV, R. Sh.**, Computation of form factors and longitudinal polarization of particle spins in electromagnetic annihilation of $p + \bar{p} \to \mu^- + \mu^+$, 20: 44188

**YAKOVLEV, B. S.**, Chemical effect of ions and electrons recombination in irradiated n heptane at 77°K, 20: 43312

**YAKOVLEV, V. P.**, Incoherent scattering in a Coulomb field, 20: 44398

**YAKOVLEVA, G. V.**, Study of the content of long-lived fission-fragment radionuclides in the Black Sea, 20: 45227

**YAKUBENKO, A. E.**, Calculation of the boundary-layer flow on an electrically conductive wall of a flat channel, 20: 44406

**YAKUBENKO, A. E.**, Computation of the boundary layer on the electrically conducting wall of a flat canal, 20: 44408

**YAMADA, Hideji**, Dispersion relation of a plasmon in an electron gas, 20: 44916

**YAMAGATA, Noboru**, Distribution of Cs and Rb in human blood, 20: 42778

**YAMAGATA, Noboru**, Environmental contamination with $^{95}$Zr–$^{95}$Nb in Japan, 20: 43615

**YAMAGUCHI, Hikoyuki**, Effect of some chemical on rejoining of chromosome breaks. I., 20: 42913

**YAMAMOTO, Yoshiaki**, Second helium flash and an origin of carbon stars, 20: 44100

**YAMANE, Toshimi**, Note on the tempering behavior of a Ti–9 wt % Ta alloy quenched from β region, 20: 43979

**YAMAOKA, H.**, Studies on radiation-induced ionic polymerization. I., 20: 43308

**YAMASAKI, Hisaiti**, Classical models of the spinning electron from WKB solutions to Pauli and Dirac equations, 20: 44268

**YAMNITSKII, V. A.**, Injection of particles into a mirror trap through magnetic cusp configuration, 20: 44971

**YANG, Chiang-sheng**, Radiation for automatically controlling level of liquid metal in crystallizer when steel is cast, 20: 43761

**YANG, T.**, Neutron decay spectrometer, 20: 43745

**YARBA, V. A.**, Helium-8 production in negative pion capture by carbon and oxygen nuclei, 20: 44770

**YARBRO, O. O.**, Philosophy of chemical processing equipment design and installation in Transuranium Processing Plant, 20: 43425 (ORNL-P-2406)

**YARMONENKO, S. P.**, Action of radiation protection agents during fractional irradiation. III., 20: 42992

**YARTSEV, E. I.**, Cesium-137 content in human bone, 20: 42741 (NP-16265)

**YARWOOD, J.**, Entrapment in tungsten of helium positive ions of kinetic energies in the range 60 ev to 1 kev, 20: 44118

**YEATER, M. L.**, Polyethylene double differential inelastic scattering cross sections for epithermal neutrons, 20: 44576 (CONF-660303, pp 122-33)

**YEH, K. C.**, Ionospheric electron content during declining phase of sunspot cycle, 20: 44449

**YERANOS, Walter A.**, Semi-empirical molecular orbital energy levels of $XeF_4$, 20: 43237

**YERGIN, P. F.**, Calibration of proton recoil detector for fast neutron spectra measurements, 20: 43669 (CONF-661001-4)

**YING, S. C.**, Acoustic nuclear spin resonance in metals, 20: 45023

**YODH, G. B.**, Classification of the $Y_1^*(1765)$ and $Y_0^*(1520)$ resonances in the 1134 representation of SU(6), 20: 44258

**YOSHIDA, Hiroshi**, Electron spin resonance study of radiation-induced solid-state polymerization of conjugated dienes, 20: 43325

**YOSHIDA, Hiroyuki**, Solvent extraction of metal ions in presence of two different chelating agents, 20: 43432

**YOSHIKAWA, M.**, Experimental observation of drift instabilities in toroidal plasma, 20: 44946

**YOSHIMI, Osamu**, Central regulation of electrocardiogram and its relation to x-ray irradiation of the head, 20: 42925

**YOUDALE, T.**, Roles of phosphate and respiration in nuclear damage in irradiated rat thymocytes, 20: 42928

**YOUMANS, Arthur H.**, Ion accelerator, 20: 44068

**YOUNG, E. F.**, New mode of field enhancement in superconducting tubes, 20: 44532

**YOUNG, H. S.**, Synthesis of Mo and W bronzes at high pressure, 20: 43213

**YOUNG, W. A.**, Calculation of weight gain in gas-metal reactions, 20: 43898 (NAA-SR-Memo-11967)

**YOUNG, W. A.**, Least squares determination of isothermal rate constants for oxidation of metals, 20: 43172 (NAA-SR-Memo-11966)

**YOUNG, W. A. P.**, Fast counting with the scintillation detector, 20: 43746

**YOUNG, W. R.**, Fabrication of a columbium alloy liquid metal loop, 20: 43879

**YOUNGBLOOD, D. H.**, Lowest T = $^3/_2$ state in $^{29}$P, 20: 44790

**YTHIER, Christian**, High energy γ radiation by means of high resolution pair spectrometer, 20: 43684

**YUAN, Luke C. L.**, Detection of relativistic particles, 20: 43738

**YUDENICH, O. K.**, Distribution of $^{131}$I-labeled insulin in the body of normal and irradiated rats, 20: 42932

**YUDIN, L. I.**, High-voltage nanosecond pulse generator, 20: 43655

**YURCHAK, R. P.**, Thermal properties of molybdenum at elevated temperatures, 20: 43977

**YUST, C. S.**, Creep of polycrystalline thorium dioxide, 20: 43941

# Z

**ZAALBERG, O. B.,** Continued immunological tolerance in mice, independent of antigen excess, 20: 42730
**ZABELIN, A. I.,** Test analysis of device for hydrogenation regeneration of decomposed gas-oil coolant, 20: 43271 (IAE-1066)
**ZACCARIA, F.,** Theorem on the Clebsch-Gordan series in A(l), B(l), C(l), and D(l), 20: 44322
**ZACKAY, V. F.,** Dynamic strain aging of a high-strength steel, 20: 43915 (UCRL-16761)
**ZAGO, G.,** Fluctuations in total neutron cross sections of Na, Al, Si, P, S in the energy interval from 5.0 to 8.5 Mev, 20: 44743
**ZAGORSKAYA, I. B.,** Seasonal variations of radiation sensitivity of rabbits, 20: 42848 (NP-16256)
**ZAIDI, S. A. A.,** Structure of the first three excited states in $^{208}$Pb, 20: 44787
**ZAIKIN, I. D.,** Standard heat of formation of Nb carbides in NbC phase, 20: 43261
**ZAIKOV, R.,** New empirical relations between baryonic masses, 20: 44299
**ZAITSEV, R. O.,** Current and magnetic field of a rotating nucleus, 20: 44833
**ZAKHAROV, V. E.,** Weak turbulence spectrum in a plasma without a magnetic field, 20: 44969
**ZAKHAROVA, S. M.,** Cross-sections of neutron reactions accompanied by emission charged particles, 20: 44671 (INDSWG-101, pp 164-223)
**ZAKHAROVA, S. M.,** Parameters of discrete resonance levels, 20: 44667 (INDSWG-101, pp 23-72a)
**ZALUCKYJ, Iwan I.,** Crystal structure of the compound $TbAl_3$, 20: 43926
**ZAMBOTTI, G.,** Interference effects in Coulomb and nuclear scattering of polarized protons, 20: 44741
**ZAMBRUNI, Laura,** Response of brown spots character of Drosophila melanogaster to treatment with x rays, 20: 42945
**ZANELLA, P.,** Test of C invariance in the three pion decay of the $\eta$ meson, 20: 44230
**ZAPOLSKY, Harold S.,** Doppler interpretation of quasar red shifts, 20: 44103
**ZARETSKAYA, Yu. M.,** Therapeutic efficacy of bone marrow in irradiation with high-energy protons, 20: 42981
**ZARKEVICH, N. F.,** Problems of experimental and clinical radiobiology, 20: 42796
**ZARKHIN, B. I.,** High-sensitivity radio-frequency mass spectrometer for investigating ionic and neutral composition of upper atmosphere, 20: 43648
**ZASIMCHUK, E. E.,** Prospects of raising the high-temperature strength of materials on the basis of refractory metals, 20: 43969
**ZATSEPIN, G. T.,** Upper limit of the spectrum of cosmic rays, 20: 44155
**ZATSEPINA, N. N.,** Basic exchange H reaction of nitrous heterocycles in liquid ammonia, 20: 43216
**ZAVIALOV, O. I.,** Simple dynamical model for baryon resonances, 20: 44365
**ZAZULIN, V. S.,** Scintillation spectrometer for simultaneous investigation of competing nuclear reactions, 20: 43681
**ZDANIS, R.,** Search for a baryon of positive strangeness, 20: 44195
**ZDRAVKOVIC, Zoran,** Standard graphite block, 20: 45060
**ZEIDLITS, P. M.,** Injection of particles into a mirror trap through magnetic cusp configuration, 20: 44971
**ZEL'DOVICH, Ya. B.,** Charge asymmetry and entropy of a hot universe, 20: 44080
**ZELIKINA, T. I.,** Cytology and cytochemistry of ribonucleoproteins in nervous system during latent period of radiation damage, 20: 42866
**ZELLER, E. J.,** Thermoluminescence of calcite from high $\gamma$ radiation doses, 20: 43552
**ZEMLYANOVA, L. I.,** Effects of radiation from $^{99}$Mo on surface structure of $MoO_3$, 20: 44026
**ZEMSKOV, G. V.,** New technique for chemical-thermal treatment of transition metals in molten aluminum-base alloys, 20: 43962
**ZENKOVA, R. A.,** Vibrational structure of the ground and excited levels of $UO_2^{++}$ in $K_4[UO_2(CO_3)_3]$, 20: 43240
**ZETTERSTROEM, H.-O.,** Multiple scattering of fast neutrons in $^{10}$B-glass scintillators, 20: 43700
**ZETTWOOG, P.,** Increase of the temperature of flames by the addition of electrical energy, 20: 44926
**ZHALILOV, O.,** High yield of early maturing cotton under influence of $\gamma$- and neutron-irradiation, 20: 42899
**ZHAVORONKOV, N. M.,** Separation coefficients of $^{12}$C and $^{14}$C by equilibrium evaporation of methane, 20: 43093 (BNL-tr-84)
**ZHDANOV, G. B.,** New method of investigating the mechanism of nuclear interactions, 20: 44192
**ZHDANOV, G. B.,** Quasi-nucleon interactions between 24 Bev/c protons and nuclei of a photographic emulsion in a strong magnetic field, 20: 44280
**ZHELEZNYAKOV, V. V.,** Negative reabsorption of synchrotron radiation, 20: 44040
**ZHELYAZKOV, I.,** Ion resonance in weakly ionized gas, 20: 44889
**ZHETBAEV, A. K.,** Electrolytic cell for radioactive isotopes, 20: 43395
**ZHMAILO, V. A.,** Coulomb photodisintegration of the deuteron as case of three-body, 20: 44827
**ZHMYROV, V. N.,** Ionization measurements in streamer chamber, 20: 43691
**ZHOKHOV, K. A.,** Boiling potassium heat transfer in tube at moderate vapor content value, 20: 43485
**ZHUKOV-VEREZHNIKOV, N. N.,** Biological effect of space-flight factors using lysogenic bacteria, 20: 42911
**ZHUKOV-VEREZHNIKOV, N. N.,** Biological studies carried out in satellites, 20: 42912
**ZHUKOV-VEREZHNIKOV, N. N.,** Phage production of E. coli induced during flights of Vostok-3 and Vostok-4, 20: 42910
**ZIELINSKI, John F.,** Medical management of Be workers, 20: 42756
**ZIEMINSKI, A.,** Electronic pulse multiplier for identification of charged particles, 20: 43670 (INR-693/I/PL)
**ZIERMANN, E.,** Measurement and control devices of the loading installation (AVR), 20: 45140
**ZIGNANI, F.,** Electrical resistivity study of recovery phenomena in cold-worked zirconium, 20: 43959
**ZIMAKOV, I. E.,** Effects of radiation from $^{99}$Mo on surface structure of $MoO_3$, 20: 44026
**ZIPF, T. F.,** $\bar{p}p$ elastic scattering for incident momenta between 1.0 and 1.50 Bev/c, 20: 44263
**ZIRWER, Dietrich,** Ozone concentrations in uv irradiation rooms, 20: 43011
**ZMBOV, K. F.,** First ionization potentials of Sa, Eu, Gd, Dy, Ho, Er, Tm, and Yb by electron-impact method, 20: 43235
**ZOGRAPHOV, DIMITER G.,** Effectiveness of bone marrow transplantation in repeated irradiation of rats, 20: 42956
**ZOLOTOTRUBOV, I. M.,** Distribution of pressure along a coaxial system after pulsed gas admission, 20: 44978
**ZOTIMOV, N. V.,** Use of ground radioactivity method for measuring snow water reserve, 20: 43559
**ZUBOV, V. A.,** Intensity distribution in induced combinational scattering spectra, 20: 44148
**ZUBOVA, N. V.,** Intensity distribution in induced combinational scattering spectra, 20: 44148
**ZUCALI, R.,** Investigation of radiosensitizer by measurement of uptake of $^{32}$P in irradiated tumors, 20: 42776
**ZUCKER, A.,** Proton accelerators as sources of slow neutrons, 20: 44581 (CONF-660303, pp 1055-63)
**ZUCKERMAN, B.,** Radio astronomical detection of helium, 20: 44081
**ZUKERMAN, V. A.,** Radioactive source of soft x radiation for physical investigations, technology, and medicine, 20: 43384
**ZULAUF, M.,** Two gauge classes and invariance of S matrix in quantum electrodynamics, 20: 44303
**ZUMEL, C. L.,** Radioprotective properties of 1-phenyl-4,5-(D-glucopyranyl)-imidazoline-2-thione and 1-p-ethoxyphenyl-4-D-arabinyltetrahydroxybutylimidazoline-2-thione, 20: 42979
**ZUORICK, G. W.,** Solvent isotope effects in amide hydrolysis, 20: 43280
**ZUTSHI, D. N.,** Tagging of hippuran with radioiodine ($^{131}$I), 20: 43403
**ZVARA, I.,** Chemical properties of element 104, 20: 43192
**ZVAROVA, T. S.,** Chemical properties of element 104, 20: 43192
**ZWANZIG, W.,** Variation (27-day) of the diurnal pattern of the intensity of cosmic radiation, 20: 44154
**ZWEIFACH, Benjamin W.,** Microcirculatory effect of serotonin on hemostasis following, 20: 42978
**ZYABKIN, V. A.,** Natural neutron background of the atmosphere and earth crust, 20: 43547
**ZYCH, A. D.,** Spark chamber for gamma-ray astronomy, 20: 43734

# SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. References to report numbers, where appropriate, are included after the abstract number of the citation. Published literature (journal article or book) is identifiable by the absence of a report number.

The user should bear in mind that the ideas presented in the original literature, rather than key words, have been indexed. The indexers have tried to select what seemed the most probable and logical place to look for typical information. Since it is not possible to anticipate where a user would look for information, numerous cross references are included in cumulative indexes to assist him in his search.

Experience in using an index of this type will be the best guide in obtaining the desired information, and a consideration of synonymous or closely related terms will prove valuable.

Information must be so indexed as to be of the greatest use to the greatest number of users. This requires that a topic be indexed to headings that most specifically describe it and not ordinarily to the headings that describe its ultimate use, nor to the general class headings that include the specific headings. For example, information on the treatment of thyroid disease with I-131 would be indexed under Thyroid Gland and under Iodine Isotopes I-131, but not necessarily under Radiotherapy. A study of the effects of x radiation on hair would be indexed under both X Radiation and Hair. However, the information would not be indexed under the experimental animal, e.g., Rats, unless the report discusses the effects on rat hair as compared with the effect on the hair of other animals.

The broad, general class headings are used only for general information or for comprehensive reports or articles.

## Subject Heading Styles

Generally, the direct form of subject entry is used rather than inverted headings, e.g., Amino Acids rather than Acids, Amino; Helium Isotopes He-4 rather than Helium—isotopes He-4 or Helium—He-4 isotopes. Note, however, that in some cases parenthetic modifying terms or inverted headings of the form Neutrons, Fast are used in preference to a direct entry that would result in the scattering of information. Organic compounds are usually entered in the index in the inverted form so that substituted compounds can be listed near the parent compound; e.g., Benzene, Bromo- rather than Bromobenzene. In general, the style of nomenclature used is that of Chemical Abstracts, except that some items listed in that publication as subheadings are elevated to form part of the main heading; e.g., Butyric Acid, Methyl Ester rather than Butyric Acid—methyl ester.

## Alphabetization

Main headings are alphabetized word-by-word. A parenthetic qualifier following a main heading is disregarded in alphabetizing unless there are two or more headings identical except for the parenthetic qualifier, in which case the qualifier determines the order. Headings involving Greek letters are arranged as if the names of the letters were spelled out.

Examples:

M-Capture
  see Electron Capture
Magnesium
Magnesium Alloys
Manganese Fluorides
Manganese(II) Fluorides
Mesons
Mesons ($\pi$)
Mesons ($\rho$)
3-Pentanol, 2,4-Dimethyl-
2-Pentanol, 2-Methyl-
2-Pentanol, 4-Methyl-

## Nomenclature of Inorganic Compounds

Inorganic compounds are indexed in the direct form, listing cations in the order of increasing valence in the case of polycationic salts of varying valence and in alphabetic order for polycationic salts in which all cations have the same valence; e.g., Sodium Aluminum Silicates and Potassium Sodium Sulfates.

## Multicomponent Alloys and Other Systems

Multicomponent alloys, except well-known trade names, are indexed under a main heading in the form "element alloy" for each element in the alloy. The modifier begins with element symbols for each component arranged alphabetically as if the English name for the element were spelled out.

Example: Copper-Gold Alloy is indexed
  Copper Alloys
    Cu-Au...
  Gold Alloys
    Cu-Au...

Well-known alloys such as Zircaloy-2 are indexed directly to the trade name; cross references referring from each component of the alloy to the entry for the trade name appear in cumulative indexes.

Multicomponent systems of non-metallic elements are indexed in a manner similar to alloys except the main heading used contains the word "Systems" in place of "Alloys."

Example: Silicon–Tungsten Systems are indexed
  Silicon Systems
    Si-W...
  Tungsten Systems
    Si-W...

Multicompound systems and mixtures of compounds are indexed under the main heading for each component compound; the modifiers begin with an alphabetical listing of compound formulas.

Example: Lead Titanate–Lead Zirconate is indexed
  Lead Titanates
    $PbTiO_3$-$PbZrO_3$...
  Lead Zirconates
    $PbTiO_3$-$PbZrO_3$...

A mixed system of compounds and elements is indexed using a combined form of the above conventions, e.g., a dispersion of copper and alumina would be indexed

  Aluminum Oxides
    $Al_2O_3$-Cu...
  Copper Systems
    $Al_2O_3$-Cu..

## Physical States and Configurations of Materials

Specification of the physical state, if other than normal, or geometric configuration of the material is included in the modifying phrase, i.e., liquid metals would be indexed to the metal with "liquid" in the modifier, and carbon crucibles would be indexed to Carbon with "crucibles" appropriately placed in the modifier and also to Crucibles if appropriate.

## Modifying Phrases

The modifiers appearing under a main heading are written specifically to describe the relation of the item being indexed to that main heading. The modifier, therefore, will generally contain more useful information about that relation than will a title or a phrase written to be used under every main heading assigned to the item. Effort is exerted to begin the modifier with the word judged to be of greatest use to the greatest number of users; this, however, does not obviate the need to consider all modifiers under the main heading(s) of interest.

Modifiers are usually intended to form a meaningful phrase when combined with the main heading. Some are intended to be read following the main heading, e.g., the entry Hydrogen—sorption by charcoal is read "hydrogen sorption by charcoal"; however, as a result of placing the important word first, many modifiers must be arranged for smooth reading, e.g., Formaldehyde—yields in radiolysis of ethyl ether, effects of deuterium on is read "effects of deuterium on formaldehyde yields in radiolysis of ethyl ether" and Uranium—crystal structure of, effect of cooling rate on allotropic transformations in is read "effect of cooling rate on allotropic transformations in crystal structure of uranium." Prepositions are sometimes omitted if no ambiguity results.

Special characters are added to modifiers in the field of physics; if the modifier does not establish the experimental or theoretical character of a reference, a symbol (E), (T), or (E/T) is placed immediately after the modifying phrase and before the journal reference number. The value of this identification has been established by the American Institute of Physics.

# A

- **ABDOMEN**
  - radiation effects on growth of intravenously injected Yoshida ascites sarcoma, 20: 42962
  - radiotherapy of tumors of, induction of enterocolitis, 20: 42994
- **ABSORPTION**
  - radiation effects on carbon-14-labeled L-alanine, by rabbit intestine, *y*, 20: 42972
- **ABSTRACTS**
  - on cancer research, 20: 42720(R) (UR-49-687, pp 177-94)
  - on cytology, 20: 42719(R) (UR-49-687, pp 117-31)
  - on decontamination methods and equipment, 20: 43569 (AED-C-13-04)
  - on health physics, 20: 43591(R) (UR-49-687, pp 132-47)
  - on hematology, 20: 42747(R) (UR-49-687, pp 148-76)
  - on plutonium, 20: 45236 (BNWL-113-17)
  - on plutonium, 20: 45237 (BNWL-113-18)
  - on radiation detectors and radiation detection instrument development, 20: 43591(R) (UR-49-687, pp 132-47)
  - on radiobiological studies, 20: 42860(R) (UR-49-687, pp 1-65)
  - on research studies at the University of Rochester for other Federal agencies, 1965, 20: 45244(R) (UR-49-687, pp 195-218)
  - on toxicity of radioelements, 20: 42746(R) (UR-49-687, pp 66-116)
  - on toxicology, 20: 42747(R) (UR-49-687, pp 148-76)
- **ACCELERATORS**
  - beam extraction and focusing system for, properties of infinite magnetic quadrupole, 20: 44055
  - beam focusing for, design of aperture-corrected quadrupole electromagnetic lenses for, (T), 20: 44047
  - calibration of proton, nuclear reaction threshold energies for, 20: 44062
  - design using coherent light, 20: 44067(P)
  - development and operation of, problems in, 20: 44053
  - effects of bremsstrahlung from, on DNA metabolism, 20: 42796
  - electromagnets for, use of conformal mapping for improving field uniformity of, 20: 44064
  - shielding design for, skyshine studies for, (E), 20: 44057
  - shielding from geomagnetic field, method for, 20: 44060
  - use of proton, as pulsed neutron sources, 20: 44581 (CONF-660303, pp 1055-63)
  - uses in industry, 20: 44051
  - vacuum window for measuring secondary emission of particle beams, design of thin foil, 20: 44066
- **ACCIDENTS**
  - radiation doses from criticality incident of $10^{17}$ fissions, 20: 43421 (NP-16216)
  - radiation monitoring manual for emergency situations after, 20: 43589 (STI-PUB-118)
  - radiological hazards from, system for evaluating, 20: 43609
- **ACETAMIDE, DICHLORO-**
  - radiation effects on single crystals of, ESR studies of coupling constants from x, 20: 43297
- **ACETAMIDE, IODO-**
  - effects on radiosensitivity of yeasts, 20: 42901
- **ACETANILIDE, 2,2,2-TRIFLUORO-*N*-METHYL-**
  - hydrolysis of, in normal and heavy water, 20: 43280
- **ACETIC ACID, BUTYL ESTER**
  - acetone–butyl acetate, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
  - butyl acetate–methanol, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
- **ACETIC ACID, [(CARBOXYMETHYLIMINO) BIS(ETHYLENENITRILO)] TETRA-**
  - analytical use for ion-exchange separation of promethium from fission product solutions, 20: 43411 (BNWL-SA-677)
  - complexes with calcium and zinc, effects on zinc-65 retention in rats, 20: 42789
  - effects on plutonium excretion in mice and rats, 20: 42997(R) (ANL-7136, pp 191-204)
- **ACETIC ACID, [(1,2-DIMETHYLETHYLENE)DINITRILO] TETRA-**
  - with lanthanides, stability constants of, polarographic determination of, 20: 43204
- **ACETIC ACID, (ETHYLENEDIAMINE) TETRA-**
  - analytical use for ion-exchange separation of promethium from fission product solutions, 20: 43411 (BNWL-SA-677)
  - use with visual indicator end points for titrimetric determination of elements, evaluation of, 20: 43067(R) (IDO-14679, pp 6-46)
- **ACETIC ACID, (ETHYLENEDIAMINE) TETRA- COMPLEXES**
  - with calcium and zinc, effects on zinc-65 retention in rats, 20: 42789
- **ACETIC ACID, (*N*-HYDROXYETHYLETHYLENEDIAMINE) TRI-**
  - analytical use for ion-exchange separation of promethium from fission product solutions, 20: 43411 (BNWL-SA-677)
- **ACETIC ACID, IODO-**
  - effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775
- **ACETIC ACID, METHYL ESTER**
  - acetone–methyl acetate, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
  - methanol–methyl acetate, solvent properties of, for rare earth in paper chromatographic separation, 20: 43452
- **ACETIN, TRI-**
  - radiolysis of, correlation of structural unit with G values of products from gamma, 20: 43296
- **ACETONE**
  - effects of liver lipids fraction of, on oxidation phosphorylation in irradiated rabbits, 20: 42825
  - hydrogen abstraction from, by *tert*-butoxy radicals, effects of deuterium on, 20: 43284
  - radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
  - acetone–acrylonitrile, radioinduced polymerization at −95 to −196°C, 20: 43277
  - acetone–cyclohexane, radiolysis of, effects of air on, 20: 43361
  - acetone–methyl acetate, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
  - acetone–butyl acetate, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
  - acetone–ethyl ethet, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
- **ACETONE, THENOYLTRIFLUORO-**
  - complexes with rare earths, preparation and properties of, 20: 43100
  - solvent properties for rare earths, 20: 43100
  - solvent properties for europium and uranyl ions, 20: 43432
  - benzene–thenoyltrifluoroacetone, solvent properties for protactinium, 20: 43431
  - thenoyltrifluoroacetone–trioctylamine, solvent properties for iron and uranium, 20: 43434
  - thenoyltrifluoroacetone–trioctylamine, solvent properties for uranium (VI), 20: 43440
  - 8-quinolinol–thenoyltrifluoroacetone, solvent properties for europium and uranyl ions, 20: 43432
- **ACETONITRILE**
  - complexes with rare earths, preparation and properties of, 20: 43231
  - effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
  - acetonitrile–$H_2O$, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
  - acetonitrile–ethanol, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
  - acetonitrile–methanol, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
- **ACETOPHENONE**
  - effects on gamma radiolysis of 2-propanol solutions, 20: 43318
  - radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
- **ACETOPHENONE, 4′-HYDROXY-**
  - effects on gamma radiolysis of 2-propanol solutions, 20: 43318
- **ACETYL CHLORIDE**
  - acetyl chloride–cyclohexane–cyclohexene, radiolysis of, effects of acetyl radical on, 20: 43361
  - acetyl chloride–cyclohexane, radiolysis of, methyl cyclohexyl ketone yields in, 20: 43361
- **ACETYL FLUORIDE, TRIFLUORO-**
  - radioinduced polymerization of, effects of temperature on gamma, 20: 43301
- **ACETYLENE**
  - ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122
  - labeling with deuterium, isotopic exchange, 20: 43409(P)
  - radiolysis of aqueous solutions of, in absence of air, variations of G values in gamma, 20: 43341
  - yields in radiolysis of ethyltoluene isomers, effects of dose, scavenger, and temperature on, 20: 43359
- **ACOUSTIC WAVES**
  - coupling of electromagnetic waves and, across plasma-air boundary, (T), 20: 44908
  - dispersion in superconductors, transverse, 20: 44536
  - excitation of ion-, in cesium and potassium plasmas, (E/T), 20: 44960
  - propagation in magnetoplasma with electromagnetic waves, (T), 20: 44899
  - propagation in metals, nuclear spin resonance in, 20: 45023
  - propagation of gravity-, in ionosphere from nuclear detonation, 20: 44448
- **ACRIDINE ORANGE**
  - radiosensitivity effects on *Escherichia coli*, uv, 20: 42838(R) (ANL-7136, pp 140-54)
- **ACRIDINES**
  - binding to DNA of, 20: 42841(R) (ANL-7136, pp 266-89)
  - deuterium exchange between, and ammonia, effects of ring position on, 20: 43216

effects on *E. coli*, reaction mechanisms for mutagenic, 20: 42838(R) (ANL-7136, pp 140-54)

**ACRYLAMIDE**
- radioinduced polymerization of, relation between velocity of in-source and post-, 20: 43323

**ACRYLIC ACID, ALKYL ESTER POLYMERS**
- alkyl acrylate polymers–polyethylene, radiation effects on, 20: 43376

**ACRYLONITRILES**
- radioinduced polymerization on cellulose, 20: 43294
- radioinduced polymerization to cyanoethylated cotton, 20: 43348
- radioinduced polymerization of emulsions of, gamma, 20: 43374
- radioinduced polymerization of crystalline, at −95 to −196°C, 20: 43277
- acetone–acrylonitrile, radioinduced polymerization at −95 to −196°C, 20: 43277
- acrylonitrile–polystyrene, radiation effects on polymers of, 20: 43355

**ACTINIDE SULFIDES**
- properties and structure of, 20: 43264

**ACTINIDES**
- deposition on metals, autoradiographic control of, 20: 43866
- preparation and uses of, 20: 43264
- preparation of carrier-free tetravalent, by sorption by iodates, 20: 43448
- recovery from underground explosion, effect of olivines in localizing, 20: 43464
- separation of plutonium from, by isotope dilution for mass spectroscopy, 20: 43067(R) (IDO-14679, pp 6-46)
- separation of tetra- from ter- and hexavalent, by sorption in iodates, 20: 43448

**ACTINIUM**
- deposition of, for target preparation, electrolytic, 20: 43396
- separation from waste solutions, 20: 43442

**ACTINIUM ISOTOPES Ac-228**
- determination of, in monazite-processing wastes for estimation of radium-228 content, 20: 43442

**ACTINOMYCIN**
- effects on antibody synthesis in rat tissue cultures, 20: 42835(R) (ANL-7136, pp 63-80)
- use with x-radiation to suppress immune response in human kidney transplantation, 20: 43032

**ACTIVATION ANALYSIS**
- activation and cooling times of samples in, optimization of, 20: 43149
- equipment for industrial neutron-, design of, 20: 43160
- gamma spectra analysis in neutron, application of Simplex method of linear programming to, 20: 43159
- of cesium and rubidium in blood fractions, neutron, 20: 42778
- review of recent trends in, 20: 43132
- sensitivity of proton, 20: 43127
- use in age determination for monazites, 20: 43134
- use in forensic science, bibliography on, 20: 43082 (PEL-116)
- use of short-lived nuclides in medical research, 20: 43022

**ACTIVATION DETECTORS**
- use in neutron dosimetry, 20: 43671 (ORNL-P-2467)

**ADENINE**
- effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

**ADENOSINE**
- effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

**ADENOSINE, DEOXY-**
- effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

**ADENOSINEPHOSPHORIC ACIDS**
- effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
- radiation effects on metabolism of ADP, AMP, and ATP, in rat bone marrow and peripheral blood, x, 20: 42788
- radiation effects on rat blood, whole-body x, 20: 42955
- uptake of exogenous, by Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

**ADHESIVES**
- radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
- use of epoxy compound, for cementing isolation rings in neutron generator accelerator tubes, 20: 44059

**ADIPIC ACID, ESTER POLYMERS**
- radiation effects on solubility and intrinsic viscosity of, gamma, 20: 43342

**ADRENAL GLANDS**
- effects on creatine excretion in $\gamma$-irradiated rats, 20: 42801
- radiation effects on catecholamine content of rat, 20: 42964

**ADRENALINE**
- effects on radioinduced hemostasis in rat mesentery microcirculation, 20: 42978

**ADRIATIC SEA**
- radioactivity of plankton samples from, 20: 43536

**ADVANCED REACTIVITY MEASUREMENT FACILITY**
- use to determine neutron cross sections and resonance absorption integrals, 20: 44621 (CONF-660303, pp 773-81)

**ADVANCED TEST REACTOR**
- control rod calibrations in ATRC, 20: 45046(R) (IDO-17192)
- fuel element development for, thermal and structural analysis, 20: 45046(R) (IDO-17192)
- neutron flux measurements in ATRC, 20: 45046(R) (IDO-17192)
- power distribution measurements in ATRC, 20: 45046(R) (IDO-17192)

**AERIAL SURVEYING**
- data from Denver, Colo., area, $\gamma$, 20: 43513 (CEX-59.4.26)

**AEROSOLS**
- clearance of uranium dioxide, from lungs of dogs, 20: 42767
- decontamination of radioactive, using foams, 20: 43585 (ORNL-TM-1589)
- inhalation of iodine-131- or isomeric technetium-99-labeled albumin, and subsequent deposition in man, 20: 42797
- ionization potentials of, for $1 \leqq Z \leqq 28$, 20: 43169 (IPP-1/49)
- monthly average of total radioactivity in West Germany, 20: 43626
- sorption of radon and thoron on, 20: 43167 (BMwF-FBK-66-11)

**AGE**
- analysis of, in patients undergoing fluoroscopy, 20: 43050
- effect on strontium-85 retention in swine, 20: 42739(R) (COO-1339-3)
- effects of, on disease occurrence and mortality patterns in survivors of atomic disasters in Japan, 20: 42697 (ABCC-18-65)
- effects of, on metabolism of iodine-131-labeled triolein in man, 20: 42782
- effects on chromosome aberrations in rats, comparison with radiation effects, 20: 42951
- radiosensitivity effects of Ephestia, on mutation spectra, x, 20: 42970
- radiosensitivity of young people as compared with old, 20: 42865

**AGE ESTIMATION**
- argon-potassium method of, for igneous rocks of the Roskruge Mountains, Arizona, 20: 43502(R) (COO-689-60, App.A-2)
- argon-potassium method of, for pegmatites near Amelia Court House, Virginia, 20: 43504(R) (COO-689-60, App.A-4)
- argon-potassium method of, for cogenetic mica and feldspar of the Catalina and Rincon Mountains, Arizona, 20: 43503(R) (COO-689-60, App.A-3)
- bibliography on, 20: 43500(R) (COO-689-60)
- carbon-14 method of, data accumulation from, 1966, 20: 43560
- comparison of carbon-14 and argon-potassium methods of, for Quaternary tephra, 20: 43506(R) (COO-689-60, App.A-6)
- lead isotopic ratio for, reliability of, 20: 43556
- lead isotopic, on volcanic magmas, 20: 43521
- lead–thorium activation method of, for monazites from Chavara (Kerala), 20: 43134
- potassium-argon method of, for metamorphic rocks of Basin and Range Province, Arizona, 20: 43501(R) (COO-689-60, App.A-1)
- radiocarbon method for Pleistocene, review, 20: 43557
- research program on, for ore deposit and volcanic rock, 20: 43500(R) (COO-689-60)
- thermoluminescence in, on geological samples, 20: 43552

**AGRICULTURE**
- control and pathology of viral diseases in domestic animals, 20: 42954
- food preservation problems in developing countries, 20: 42727
- radioactive contamination of surface waters used in, survey, 20: 43598
- radium-226 uptake by vegetables and cereals, relation to soil content, 20: 42792
- use of herbicides in weed control, tracer methods for, 20: 42742 (STI-PUB-113)
- use of radioinduced mutations in plant breeding programs, 20: 42846 (IAEA-2466-13)

**AIR**
- acoustic-electromagnetic wave coupling across boundary of plasma and, (T), 20: 44908
- analysis for hydrocarbons in containment building, equipment for, 20: 43068(R) (IDO-14679, pp 47-50)
- corrosive effects of stainless steel 304, 20: 45106(R) (ANL-7249)
- decontamination of, containing radioiodine and particulates using foams, 20: 43585 (ORNL-TM-1589)
- effects on gamma-induced inactivation of transforming DNA, 20: 42818
- effects on mechanical properties of steels at 1100°F, 20: 43897 (MSAR-66-174)
- ignition of irradium in, mechanisms of, 20: 43611
- ionization energy in, measurement of effective, 20: 43193
- maximum permissible limits for beryllium in, 20: 42755
- maximum permissible concentration of ozone in uv irradiation rooms, 20: 43011
- oxidative effects on Hastelloy X at 1750°F, 20: 43838 (TID-23319)
- oxidative effects on graphite, inhibition by chlorofluoromethanes, (E), 20: 43839
- oxidizing effects on silicon carbide-coated graphite at 1000°C,

20: 43825 (BNWL-242)
plutonium contamination at production areas, particle size studies, 20: 43595
radioactivity content of, from fallout in West Germany, 20: 43626
radioprotective effects on *Vicia faba* seedlings, 20: 43007
shock waves in, electron and ion density ahead of, 20: 44403(R) (AD-628143)

**AIRCRAFT**
assembly of beryllium alloy components for, methods of, 20: 43859 (NASA-TM-X-53453(Vol.6))
components for, heat treatment methods for beryllium alloy, 20: 43858 (NASA-TM-X-53453(Vol.5))
components of, cleaning and surface preparation for fabrication of beryllium alloy, 20: 43857 (NASA-TM-X-53453(Vol.4))
components of, forming methods for beryllium alloy, 20: 43856 (NASA-TM-X-53453(Vol.2))
use in high-altitude cosmic radiation, comet, and solar eclipse studies, 20: 44417 (LA-DC-7837)

**ALANINE**
acceptance by t-RNA, effects of horseradish peroxidase, 20: 42809
polymers of, gamma-induced changes in properties of, 20: 42826
radiation effects on synthesis in *Micrococcus glutamicus*, fast neutron and γ, 20: 42914
radiation effects on intestinal absorption of carbon-14-labeled L-, in rabbits, gamma, 20: 42972

**β-ALANINE, 2-METHYL-**
radiation effects on rat urinary excretion of, effects of thymidine injection on, 20: 42807

**ALASKA**
radioactivity of biota and humans of, 20: 43005

**ALBUMINS**
deposition of iodine-131- or isomeric technetium-99-labeled, following inhalation, 20: 42797
effects of serum, on oxidation phosphorylation in mitochondria of irradiated rabbits, 20: 42825
effects on esterase activity in kidneys and liver of x-irradiated rats, 20: 42824
labeling blood-serum, with iodine-131, 20: 43397
localization of arsonazo serum, in tumors in mice, 20: 42840(R) (ANL-7136, pp 164-90)
preparation of technetium-99-labeled human serum, for scintillation scanning of lungs, 20: 43390
radiation dose to gastrointestinal tract from ingested iodine-131-labeled, 20: 43043
radiation effects on frog serum content, gamma, 20: 42787
radiation effects on serum fractions of rabbits, x, 20: 42870
zinc-65 bonding in guinea-pig serum, 20: 42791

**ALCOHOLS**
radioprotective effects on *Vicia faba* seedlings, 20: 43007

**ALDEHYDES**
yields in irradiation of hydrocarbon and carbon dioxide mixtures, 20: 43333

**ALGAE**
ecology of Northeast Pacific Ocean, tracer study, 20: 42731(R) (RLO-1751-2)
radiation effects on *Nitella flexilis*, x, 20: 42998(R) (EUR-2992.f)

**ALIZARIN**
analytical use in qualitative analysis of tetravalent and trivalent cerium mixtures, 20: 43122

**ALKALI METAL CHLORIDES**
effects of melts of, on preparation of uranium dioxide from uranium tetrachloride, 20: 43185 (ZFK-WF-25)

**ALKALI METAL HALIDES**
radiation effects on crystal structure of, neutron, 20: 43303

**ALKANES**
radioinduced production in meats, 20: 42973

**ALKENES**
radioinduced addition of formamide to, electron and gamma, 20: 43347

**ALLENE**
radioinduced production in meats, 20: 42973

**ALLOYS**
analysis for uranium, extraction-spectrophotometric, 20: 43067(R) (IDO-14679, pp 6-46)
analysis for uranium, extraction-spectrophotometric, 20: 43071 (IDO-14679, pp 75-191)
superconducting properties of eutectic, effects of structure on, (E), 20: 44514

**ALPHA BEAMS**
production of, device for, 20: 44145

**ALPHA DECAY**
energy release in, systematics of, 20: 44821
theory of, alpha-nucleus potential in, 20: 44763

**ALPHA PARTICLES**
detection of, design of scintillation counter for, 20: 43750
effects on animals, lethal, 20: 42934
effects on crystal lattices, 20: 43987 (BNL-10569)
effects on diffusion of lead in silver, (E/T), 20: 44002
effects on DNA molecule, site and mechanism of action, 20: 42821
effects on ductility of 316 stainless steels, 20: 44015
effects on growth of animal cells in monolayer cultures, 20: 42943
effects on metabolism of calcium-47 and strontium-85 following pituitary irradiation, 20: 42744(R) (UCRL-16246, pp 19-35)
effects on mice and rats from deposited plutonium, carcinogenic, 20: 42997(R) (ANL-7136, pp 191-204)
effects on pituitary, relation of dose in time to, 20: 43016(R) (UCRL-16246, pp 58-65)
effects on semicircular-canal function in rabbits, 20: 42858(R) (UCRL-16246, pp 74-83)
effects on water, diffusion kinetics for, (T), 20: 43288(R) (CALT-532-1)
energy loss and straggling in metal foils, 20: 44144
inactivating effect on enzymes, comparison with gamma radiation, 20: 42816
reactions (α,d) with calcium-40 at 24.8 Mev, angular distribution from, (E), 20: 43717
reactions (α,n) with beryllium-9 at 4.3 to 12.0 Mev, carbon-13 energy levels from, (E), 20: 44723
reactions (α,p) with magnesium-24, testing T-invariance by, (E), 20: 44793
reactions (α,2n) with neodymium-150 at 18 to 20.5 Mev, samarium-152 energy-level transitions from, (E), 20: 44735
reactions (α,2n) with samarium-152 at 18 to 20.5 Mev, gadolinium-154 energy-level transitions from, (E), 20: 44735
reactions (α,2n) with samarium-154 at 18 to 20.5 Mev, gadolinium-156 energy-level transitions from, (E), 20: 44735
reactions with gases, ionization cross sections and mass spectra for, (E), 20: 44122
scattering by carbon-12, differential cross sections for, (E), 20: 43741
scattering by even-even nuclei with $46 \leq A \leq 64$, vibrational energy levels from inelastic, (E/T), 20: 44795
scattering by gold at 60°, 20: 43742
scattering by spherical even-even nuclei, quadrupole and octupole energy-level transitions from, (E/T), 20: 44799
track recording by electron avalanches and charge imaging, (T), 20: 43743
use in pituitary therapy, patient alignment techniques for, 20: 43017(R) (UCRL-16246, pp 66-73)

**ALPHA SOURCES**
proton emission by polonium-210, (E), 20: 44686

**ALPHA SPECTROMETERS**
design and performance of scintillation, with proton discrimination, 20: 43681

**ALTERNATING-GRADIENT FOCUSING**
use for molecular beams, 20: 44120

**ALTITUDE**
effects of simulated, on iodine turnover in rats, 20: 42745(R) (UCRL-16246, pp 126-37)
radiosensitivity effects in barley, γ, 20: 42894

**ALUMINUM**
acoustic wave attenuation in superconducting, transverse, 20: 44536
alpha particle energy loss and straggling in foils of, 20: 44144
analysis for iridium, spectrochemical, 20: 43068(R) (IDO-14679, pp 47-50)
analysis for oxygen and sodium, activation methods for, 20: 43155
analysis for trace amounts of copper by isotope dilution and activation methods, 20: 43137
coating with actinides, target preparation by, 20: 43396
corrosion by copper sulfate solution at 50°C, 20: 43824 (ANL-6236)
corrosion by flowing water at pH 5 and 100°C, dynamic, 20: 43833 (ORNL-TM-1030)
corrosion of electroless nickel-coated 6061, 20: 45046(R) (IDO-17192)
deposition and performance as coating for transition metals, 20: 43962
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in aluminum–copper alloys using EDTA, chelometric, 20: 43069(R) (IDO-14679, pp 51-9)
determination in aluminum-coated thorium slugs, titrimetric, 20: 43071 (IDO-14679, pp 75-191)
determination in powder samples by spectrographic methods, semiquantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination of trace amounts of, in tungsten by atomic absorption spectrophotometry, 20: 43154
deuteron stopping at 5 to 12 Mev in foils of, 20: 44034
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
effects on sintering of alumina, 20: 43813(R) (COO-1122-3)

electromagnetic wave propagation in, helicon, (E), 20: 44993 (NYO-2150-19)
electron and proton diffraction channelling in crystals of, fast, 20: 44134
electron reactions at 18 Mev, anomalous secondary electron emission from, 20: 44117
electron scattering at 3.5 to 14.1 Mev on, backscattering from, (E), 20: 44115
electron-induced transition radiation and bremsstrahlung from foils of, grazing-incidence, 20: 44111 (ORNL-TM-1571)
expansion of tubular, equipment for measuring, 20: 43960
fracture toughness of, 20: 43912 (UCRL-14859)
gamma attenuation in, tables of equivalent thickness of, 20: 44989
neutron cross sections from 0.037 ev to 18 Mev, tables of, 20: 44661 (UNC-5139)
neutron inelastic scattering, 20: 44613 (CONF-660303, pp 577-98)
neutron nonelastic scattering at 2.52 Bev, (E), 20: 44828
neutron total cross section from 5.0 to 8.5 Mev, fluctuations in, (E), 20: 44743
photoelectric and optical properties of films of, in extreme ultraviolet, (E), 20: 44995 (ORNL-TM-1392)
pressure bonding on thorium tubes, process for, 20: 43861 (TID-12860)
proton reactions at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
proton stopping at 5 to 12 Mev, in foils of, 20: 44034
radiation effects on electrical resistivity, stored energy, and volume, correlation with defects, 20: 45037
radioinduced defects in, recovery from, (E/T), 20: 45040
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
separation of lithium from, 20: 43067(R) (IDO-14679, pp 6-46)
separation of protactinium from, by sorption on activated charcoal, 20: 43148
solar ion capture using foils of, 20: 44697
spectra from pulsed, discharge-produced plasma of, 20: 44959
superconducting transition temperatures of, crystallite size effects on, 20: 44552
use in G-M counters with activable cathodes, for measurement of fast neutron fluxes, 20: 43729
use in spark chambers, foil streching device for, 20: 43724

**ALUMINUM ALLOYS**
analysis for oxygen and sodium, activation methods for, 20: 43155
corrosion by copper sulfate solution at 50°C, 20: 43824 (ANL-6236)
corrosion by flowing water at pH 5 and 100°C, dynamic, 20: 43833 (ORNL-TM-1030)
deposition and performance as coating for transition metals, 20: 43962
wear and corrosion testing as journal bearing material, 20: 43823 (AECL-2566)
Al–Ce, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Cr–Fe, corrosion in oxidizing atmospheres at high temperature, 20: 43842
Al–Cr–Fe–Mo–Ti, properties of, effects of high-temperature thromomechanical treatment on, 20: 43961
Al–Cu, analysis for aluminum and copper using EDTA, chelometric, 20: 43069(R) (IDO-14679, pp 51-9)
Al–Cu, radiation effects on deformation structure of, neutron, 20: 44003
Al–Dy, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Er, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Eu, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Fe–Mn–U, intermetallic compounds of, phase diagrams, 20: 43980
Al–Gd, gadolinium-155 energy levels in $GdAl_2$, magnetic hyperfine structure of, (E), 20: 44832
Al–Gd, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Ho, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–La, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Lu, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Nb–Ti, properties at high temperatures, 20: 43963
Al–Nd, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Pr, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Pu, handling and storage of, safety aspects of, 20: 43578 (HW-59541)
Al–rare earth, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Sc, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Sm, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Sn, deposition and performance as oxidation-resistant coating for niobium alloys, 20: 43827 (GTR-19)
Al–Sn, deposition and oxidation protection of coatings of, on niobium and niobium alloys, 20: 43836 (TID-17070)
Al–Sn, use of coatings of, for corrosion protection of niobium–zirconium alloys, 20: 43837 (TIM-823)
Al–Tb, crystal structure of intermetallic compound, 20: 43926
Al–Tb, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Tu, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–U, combustion kinetics of, 20: 43612
Al–U, formation of intermetallic compound, in high-temperature SAP-uranium reactions, 20: 43835 (RISO-91)
Al–U, oxidation of uranium-base, kinetics at 300 to 625°C, 20: 43841
Al–U, thermal conductivity of aluminum-clad plates of, 20: 43811(R) (BNWL-269, pp 1.1-28)
Al–U, use of powdered intermetallic compound, in dispersion fuel elements, 20: 43822
Al–Y, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–Yb, properties of intermetallic compounds in, tabulation of, 20: 43972

**ALUMINUM CARBIDES**
formation by explosive shock, 20: 43952

**ALUMINUM COUPLES**
Al/Cu, corrosion by water at 50°C, 20: 43824 (ANL-6236)
Al/Ni, corrosion by water at 50°C, 20: 43824 (ANL-6236)

**ALUMINUM IONS**
effects on cobalt determination in steel, 20: 43145
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100

**ALUMINUM ISOTOPES Al-24**
mass from threshold energy for magnesium-24 (p,n) reactions, (E), 20: 44811

**ALUMINUM ISOTOPES Al-26**
energy levels from magnesium-25 (d,n) and (He-3,d) reactions, (E), 20: 44601(R) (ANL-7218)
energy levels from magnesium-24 (d,α) reactions, 20: 44768
gamma spectra, 20: 44634(R) (IDO-17188)

**ALUMINUM ISOTOPES Al-27**
deuteron reactions (d,n), angular and energy distributions from, 20: 43550(R) (NYO-844-67)
meson (π) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
proton reactions (p,α) with, testing T-invariance by, (E), 20: 44793

**ALUMINUM NITRATES**
effects on calcination of phosphomolybdate solutions, 20: 43186(T) (ORNL-tr-1344)
$Al(NO_3)_3$–HF–$HNO_3$, effects on dissolution of aluminum-canned irradiated thorium dioxide, 20: 43412 (DP-1044)

**ALUMINUM OXIDES**
compatibility with coatings of carbon, molybdenum, tantalum, and tungsten at high temperatures, 20: 43927
deformation on aluminum, mechanisms of anodic film, 20: 43949
degassing of, 20: 43815(R) (NASA-CR-54356)
determination in bauxite by neutron well-logging, 20: 43554
effects of additions of pelletized, on curing stresses in epoxy resins, 20: 43906 (ORNL-P-2361)
electric properties as capacitor material, 20: 43815(R) (NASA-CR-54356)
electric resistivity of flame-sprayed coatings of, 20: 43927
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
preparation and properties of liquid window of, 20: 43179(R) (NYO-2082-6)
sintering kinetics of, effects of aluminum and manganese oxide on, 20: 43813(R) (COO-1122-3)
sintering kinetics of composite compacts of, 20: 43813(R) (COO-1122-3)
thermal conductivity of powders of, under compressive stress, 20: 45056
$Al_2O_3$–$Al_2TiO_5$, emissivity as coating in tests of niobium–zirconium alloys, 20: 43816(R) (PWA-2877)
$Al_2O_3$–Ni, mechanical properties of alumina-whisker reinforced, 20: 43848(R) (BNWL-269, pp 5.1-36)
$Al_2O_3$–Ni, oxidation and properties of, effects of high temperatures on composites of, 20: 43845(R) (AD-637573)
$Al_2O_3$–Ni, oxidation and properties of, effects of high temperatures on cermet, 20: 43845(R) (AD-637573)
$Al_2O_3$–$UO_2$–$Y_2O_3$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)

**ALUMINUM SILICATES**
properties for decontamination of radioactive solutions, effects of calcium, magnesium, potassium, and sodium oxides on ion-exchange, 20: 43449

**ALUMINUM SYSTEMS**
Al–Si, properties of intermetallic compounds in, tabulation of, 20: 43972
Al–$UO_3$–$U_3O_8$, fabrication into reactor fuel plates, 20: 43844 (AAEC-TM-315)

**ALUMINUM TITANATES**
$Al_2O_3$–$Al_2TiO_5$, emissivity as coating in tests of niobium–zirconium alloys, 20: 43816(R) (PWA-2877)

**ALUMINUM, TRIMETHYL-**
spectra of hydrogen and lithium-7 in ether solutions of, NMR, 20: 43392
lithium tetramethylaluminate–trimethylaluminum, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetramethylborate–trimethylaluminum, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392

**AMERICIUM**
deposition of, for target preparation, electrolytic, 20: 43396

determination by charged-particle reactions at 2 Mev, 20: 43097
purification of, multi-channel ion exchange process for, 20: 43183 (RL-SEP-729(Rev.))
separation from aqueous solutions by solvent extraction using di-acidic phosphorus-based compounds, 20: 43445
separation from aqueous solutions by solvent extraction using dinonylnaphthalenesulfonic acid and its sodium salt, 20: 43447
separation from curium-242, electrolytic and ion exchange, 20: 43453
separation from neptunium, plutonium, thorium, and uranium by solvent extraction, 20: 43072(R) (IDO-14679, pp 193-229)
separation of, from cesium and zirconium by paper electrophoresis, 20: 43451

**AMERICIUM IONS**
electromigration of trivalent, in sodium hexametaphosphate during paper electrophoresis, 20: 43451

**AMERICIUM ISOTOPES Am-241**
deposition on metals, autoradiographic control of, 20: 43866
determination in fission product samples, extraction-radiometric, 20: 43072(R) (IDO-14679, pp 193-229)
determination in presence of actinides, extraction-radiometric, 20: 43067(R) (IDO-14679, pp 6-46)
determination in the presence of plutonium-238, coincidence methods for, 20: 43158
distribution from nuclear explosion in salt deposit, 20: 43802
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)
use in radiographic instruments for density measurements of bone and soft tissue, 20: 43049

**AMERICIUM ISOTOPES Am-242**
neutron fission of isomeric, cross section for thermal, (E), 20: 44708

**AMERICIUM ISOTOPES Am-243**
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)

**AMERICIUM SYSTEMS**
Am–O, phase studies, 20: 43811(R) (BNWL-269, pp 1.1-28)

**AMIDE POLYMERS**
radiation effects on fibers of, gamma, 20: 43331

**AMINES**
preparation of secondary and tertiary, for use in solvent extraction of uranium, 20: 43429

**AMINO ACIDS**
acceptance by t-RNA, effects of ultraviolet radiation, 20: 42809
effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775
formation during electron irradiation of primitive Earth atmosphere, tracer studies of, 20: 42726
iodo-, identification of thyroidal, by gel filtration and automated iodine-127 determination, 20: 42774
polymers of, gamma-induced changes in properties of, 20: 42826
radiation effects on bone marrow content, gamma, 20: 42796
radiation effects on splitting of, from myoglobins, gamma, 20: 42799(R) (UCB-34P95-1)
radiation effects on malonaldehyde production in, 20: 42799(R) (UCB-34P95-1)
radiation effects on synthesis in *Micrococcus glutamicus*, fast neutron and $\gamma$, 20: 42914
radioinduced formation of carbon dioxide, sulfur dioxide, hydrogen sulfide, carbonyl sulfide, dimethyl sulfide, and methyl mercaptan from, in meats, 20: 42973
uptake by proteins in chloroplast-containing fractions of bean leaf homogenate, 20: 42706(R) (NYO-2373-1)

**AMMONIA**
determination in aqueous solutions and solids, titrimetric, 20: 43071 (IDO-14679, pp 75-191)
deuterium exchange between, and heterocyclic nitrogen compounds, effects of ring position on, 20: 43216
effects on radioinduced polymerization of styrene, $\alpha$-methylstyrene, and isobutyl vinyl ether, 20: 43338
neutron scattering by gaseous, cold, (T), 20: 44599
production of, chemonuclear processes for, 20: 43300
scattering of molecular beams of, by silver single crystals, (E), 20: 44121

**AMMONIUM CERIUM SULFATES**
radioisotope incorporation in tetrahydrated, mixed crystal formation in, 20: 43252

**AMMONIUM CHROMATES**
use in preparation of high-specific-activity chromium-51, 20: 43401

**AMMONIUM COMPOUNDS, CUATERNARY**
bromine-82 exchange between benzyldimethylphenylammonium bromide or tetraethylammonium bromide and acetyl bromide, 20: 43247

**AMMONIUM HYDROXIDES**
properties as carrier for actinium-228, 20: 43442

**AMMONIUM IONS**
reactions of monovalent, with dinonylnaphthalenesulfonic acid, effects of diluent on, 20: 43447

**AMMONIUM MOLYBDATES**
analytical use in qualitative analysis of tetravalent and trivalent cerium mixtures, 20: 43122

**AMMONIUM THALLIUM SULFATES**
radioisotope incorporation in tetrahydrated, mixed crystal formation in, 20: 43252

**AMMONIUM TUNGSTOCERATES**
preparation and physicochemical properties, 20: 43253

**AMMONIUM URANATES**
filterability of, for preparing uranium oxides from chloride and nitrate solutions, 20: 43428 (RL-SEP-924)
properties as feed materials, effects of particle size on, 20: 43202

**AMOEBA**
effects of nitrogen mustard on, lethal, 20: 42997(R) (ANL-7136, pp 191-204)
preparation of nuclei of, for use as toxicity test system, 20: 42997(R) (ANL-7136, pp 191-204)
radiation effects on, lethal, x, 20: 42997(R) (ANL-7136, pp 191-204)

**AMPHIBIANS**
germ cell differentiation in, 20: 42839(R) (ANL-7126, pp 154-61)

**AMYLASES**
effects on biochemistry and electrophoretic behavior of rat erythrocytes, 20: 42714 (UCRL-16246, pp 119-25)
radiation effects on alpha and beta, in corn and potato starch, gamma, 20: 42798 (NP-16224)

**AMYLOID**
content in intestine of rats, 20: 42835(R) (ANL-7136, pp 63-80)

**ANALYSIS**
scintillation spectrometry methods of, review of, 20: 43096
surface, using charged particles from 2-Mev accelerator, 20: 43097

**ANEMIA**
iron content in persons with, 20: 42908

**ANESTHETICS**
effects of barbamyl on oxygen content in rat tissues, 20: 43008

**ANILINE**
deuterium exchange between, and deuterium oxide, effects of cobalt, nickel, and platinum on, 20: 43275

**ANIMAL CARE**
program for laboratory mice, 20: 42699(R) (ANL-7136, pp 94-108)

**ANIMAL CELLS**
differentiation of amphibian, 20: 42839(R) (ANL-7136, pp 154-61)
differentiation of lens, in early chick embryos, 20: 42839(R) (ANL-7136, pp 154-61)
effects of enzymes on protein metabolism of Ehrlich's ascitic carcinoma, 20: 42728
effects of macrophages from irradiated donors on ability to transfer antibody formation, 20: 42830 (AD-635598)
ion binding properties of lipoproteins in membranes of, 20: 42743 (UCRL-14631)
lymphoid, studies of functions of, by autoradiography, 20: 42784
pathological characteristics of leukemic reticulosis and leukemic reticulosarcomatosis, 20: 42729
photoreactivation of ultraviolet damage in mammalian, 20: 42869
proliferation of mouse epithelial, 20: 42834(R) (ANL-7136, pp 46-63)
properties of stem cell, 20: 42705 (BNL-10405)
protective effects of post-irradiation oxygen starvation against injuries to nuclear structure in x-irradiated rat thymocyte, 20: 42989
radiation effects on rabbit cartilaginous, Thorotrast, 20: 42772
radiation effects on DNA metabolism, *in vitro* studies, x, 20: 42777
radiation effects on cultured hamster, neutron and x, 20: 42841(R) (ANL-7136, pp 266-89)
radiation effects on Ehrlich ascites tumor, electron-beam and x-ray, 20: 42817
radiation effects on bone marrow, comparative studies, 20: 42822
radiation effects on growth of, from mouse fibrosarcoma, x, 20: 42888
radiation effects on chromosomes in silkwork spermatocyte, uv, 20: 42895
radiation effects on growth of monolayer tissue cultures of, RBE for $\alpha$ and $\gamma$, 20: 42943
radiation injuries in rabbit intestinal, following duodenal injection of carbon-14-labeled L-alanine, $\gamma$, 20: 42972
radioinduced carcinogenic transformation in hamster, *in vitro*, x, 20: 42927
radioinduced chromosome aberrations in cultured, effects of infrared radiation on x, 20: 42837(R) (ANL-7136, pp 124-40)
radioinduced loosening of colonies of HeLa, electron, 20: 42963
radiosensitivity of mouse epithelial, $\gamma$, 20: 42834(R) (ANL-7136, pp 46-63)
theoretical elimination of immunologically competent, 20: 42705 (BNL-10405)
ultrastructure of thymic, in mice suffering from radioinduced leukemia or thymic lymphoma, 20: 42882
use of mouse fetal liver, in treatment of leukemia, 20: 42893
virus particles on Ehrlich ascites, relation to antigenic material, 20: 42712(R) (UCRL-16246, pp 51-7)

**ANIMAL REPRODUCTION**
radiation effects on *Ips confusus*, $\gamma$, 20: 42883
reproduction–radiation effects on rat, local x, 20: 42961
**ANIMAL RESPIRATION**
effects of rat, on x-radioinduced nuclear damage in thymocytes, 20: 42989
effects on radiation damage in thymocyte nuclei, x, 20: 42928
radiation effects on, in developing salmon spawn and larvae, $\gamma$, 20: 42820
**ANIMALS**
control of viral infections in domestic, 20: 42954
growth of young post-natal, dynamics of, 20: 42840(R) (ANL-7136, pp 164-90)
hazards to, from radioactive contamination of surface waters, 20: 43598
irradiation of, using cobalt-60 well irradiator, 20: 43613
medical studies of, use of radioisotopes in, 20: 42723
pathology of viral diseases in domestic, 20: 42954
radiation injury recovery kinetics in, statistical analysis of, 20: 42829 (AD-635167)
radioactive contamination levels in aquatic and marine, 20: 43596
radioisotope contents in Arctic, 20: 43005
radiosensitivity of, physiological parameters in, 20: 42849 (NP-16258)
**ANION EXCHANGE MATERIALS**
diffusion of plutonium isotopes in Dowex-1, 20: 43418 (LA-3534)
**ANIONS**
binding by lipoproteins in blood serum and cell membranes, 20: 42743 (UCRL-14631)
localization of cobalt phthalocyanine tetrasulfonate, in tumors in mice, 20: 42840(R) (ANL-7136, pp 164-90)
**ANNEALING**
effects of pre-irradiation, on radioinduced thermoluminescence of magnesium-doped lithium fluoride, (E), 20: 45008
effects on critical shear stress of neutron-irradiated nickel, 20: 45038
effects on species specificity of animal DNA, 20: 42757
**ANOXIA**
effects of, on *in vitro* development of nuclear homogeneity by irradiated rat thymocytes, 20: 42928
effects on sodium ion efflux from rat liver slices, 20: 42758
protective effects of, against x-radioinduced injuries to rat thymocyte nuclei, 20: 42989
radiosensitivity effects in mice, 20: 42988
**ANTARCTIC OCEAN**
analysis for copper, manganese, and zinc, activation, 20: 43085(R) (TID-23295, Sect.2)
**ANTHRANILIC ACID**
n,n′-dimethyl-, solubility of, in heavy water, isotope effects on role of hydrogen bonds in, 20: 43287
**ANTIBIOTIC THERAPY**
use for control of bacterial infections during radiation sickness, 20: 43052
**ANTIBIOTICS**
effects on sodium ion efflux from rat liver slices, 20: 42759
radiosensitivity effects on lethally irradiated monkeys, in combination blood platelets and bone marrow, 20: 42980
**ANTIBODIES**
formation in rabbits, 20: 42855(R) (TID-23203)
formation in rabbits, effects of macrophages from irradiated donors on, 20: 42830 (AD-635598)
radiation effects on synthesis of, in rats, x, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on production of diphtheria and tetanus, in guinea pigs, x, 20: 42887
synthesis in rat tissue cultures, effects of actinomycin D on, 20: 42835(R) (ANL-7136, pp 63-80)
**ANTIFERROMAGNETIC MATERIALS**
electromagnetic, plasma, and spin wave interactions in, coupling of, 20: 43982
excitations in, Goldstone theory for, 20: 45042
Green's function method for antiferromagnetism, 20: 44029 (IS-T-99)
**ANTIGENS**
content in mice, effects on immunological tolerance of radiation chimeras, 20: 42730
immune reactions of rabbits to, 20: 42855(R) (TID-23203)
particles of, relation to virus particles on Ehrlich ascites tumor cells, 20: 42712(R) (UCRL-16246, pp 51-7)
radiation effects on localization in rats, x, 20: 42835(R) (ANL-7136, pp 63-80)
**ANTIMONY**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in natural materials, activation, 20: 43080 (ORO-2670-15)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in seawater by activation and gamma spectrometry, 20: 43059 (BNWL-SA-674)
determination of, in carbazole by neutron activation methods, 20: 43116
electron energy losses at 28.5 Mev in thin foils of, 20: 45003
magnetic susceptibility at ultralow temperatures, 20: 44569
neutron capture cross section discrepancies for, explanation by boron $(n,\alpha)$ cross sections in flux monitoring, 20: 44611 (CONF-660303, pp 486-501)
nuclear magnetic fields in iron, (E), 20: 44824
**ANTIMONY ALLOYS**
Sb–Pb, superconducting transition temperatures of, 20: 44515
Sb–Sn, magnetic flux retention in hysteretic superconducting, 20: 44521
**ANTIMONY ISOTOPES**
separation of neutron-deficient, from tin isotopes, 20: 43067(R) (IDO-14679, pp 6-46)
**ANTIMONY ISOTOPES Sb-118**
gamma spectra, 20: 44634(R) (IDO-17188)
**ANTIMONY ISOTOPES Sb-122**
nuclear magnetic fields in iron, (E), 20: 44824
**ANTIMONY ISOTOPES Sb-124**
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
**ANTIMONY ISOTOPES Sb-125**
contamination of pig skin by, effect of acidity of soiling solution on, 20: 43010
energy levels from beta decay of tin-125, (E), 20: 44705
production of carrier-free, 20: 43398
**ANTIMONY TELLURIDES**
wear effects in variation against SAP, 20: 43843
**ANTIPARTICLES**
abundance in relation to particles in universe, 20: 44097
book: *Antimatter*, 20: 44282
interactions in atmosphere, (T), 20: 44037
**ANTIPROTONS**
interactions with protons, effects of form factors on cross sections for $\mu^-\mu^+$ annihilation, 20: 44188
interactions with protons, quark model predictions for annihilation, (E/T), 20: 44224
interactions with protons at 5 to 9 Bev/c, cross sections for charge-exchange, (E), 20: 44227
interactions with protons at 1.0 to 2.50 Bev/c, cross sections for elastic, (E), 20: 44263
interactions with protons, Regge trajectories for minima in differential cross sections for, 20: 44264
interactions with protons at high energies, models for inelastic two-body, 20: 44359
production and annihilation of, 20: 44282
**ANTIPYRINE**
complexes with rare earths and salicylates, benzene solvent extraction studies on, 20: 43256
**ARGON**
content of radiogenic, in Virginia pegmatites, 20: 43504(R) (COO-689-60, App.A-4)
current-voltage curves for negative bias probes in plasma of, (E), 20: 44909
currents in hypersonic plasma jets of, nozzle, (E/T), 20: 44886
diagnostics of low-density plasma of, Langmuir probe for, (E), 20: 44876
diagnostics of plasma of, stagnation point Langmuir probe, (E), 20: 44878
effects on properties and structure of tungsten crystallized in, 20: 43937
effects on radiolysis of liquid propane, 20: 43368
electric conductivity of potassium-seeded plasma of, variable collision cross section effects on, (T), 20: 44877
electric discharge dynamics of, in gas laser, 20: 44410
electron density maximization in Penning gas mixture with, ionized by fission fragments, 20: 44933
electronic recombination in afterglow plasma of, 20: 44854 (AD-630074)
fission fragment energy-losses in, (E), 20: 44685
glow discharges in, energy balance of steady-state, 20: 44961
ion resonance in weakly ionized plasma of, 20: 44889
ionization energy in, measurement of effective, 20: 43193
ionization of, by shock heating, mass spectroscopic studies of effects of impurities in, 20: 43123
scattering of molecular beams of, by silver single crystals, (E), 20: 44121
sorption by zeolites at low pressures and temperatures, 20: 43499
spectra from plasma of, Stark widths of, 20: 44931
**ARGON IONS**
capture of solar, using aluminum foils, 20: 44697
effects on gain of electron multiplier tubes, (E), 20: 43659
effects on glass surfaces up to 30 kev, 20: 45017
sputtering on copper at 5 kev, scanning spectrometer for determining yields from, 20: 43660
**ARGON ISOTOPES**
use in geological dating, method and equipment for, 20: 43500(R) (COO-689-60)
use in geological dating, method for, 20: 43501(R) (COO-689-60, App.A-1)
use in geological dating, method for, 20: 43502(R) (COO-689-60, App.A-2)

- use in geological dating, method for, 20: 43504(R) (COO-689-60, App.A-4)
- use in geological dating, method for, 20: 43506(R) (COO-689-60, App.A-6)
- use in geological dating, method for, 20: 43503(R) (COO-689-60, App. A-3)

**ARGON ISOTOPES Ar-34**
- beta decay of chlorine-34 energy-level quantum numbers and transitions from, (E), 20: 44759

**ARGON ISOTOPES Ar-36**
- content in solar flares, 20: 44104
- deuteron reactions (d,n) with, potassium-37 energy levels from, (E), 20: 44838
- helium-3 reactions (He-3,d) with, potassium-37 energy levels from, (E), 20: 44838
- proton reactions (p,p), (p,$\gamma$), and (p,p$\gamma$) with, potassium-37 energy levels from, (E), 20: 44838

**ARGON ISOTOPES Ar-38**
- content in solar flares, 20: 44104

**ARGON ISOTOPES Ar-40**
- use in age estimations for Pleistocene events, 20: 43557

**ARGON ISOTOPES Ar-41**
- determination of, by beta counting, ionization chamber for, 20: 43106

**ARGON SYSTEMS**
- Ar–methane, electron ionization loss at 20 to 150 Mev in, 20: 44232
- Ar–methane, ionization energy in, measurement of effective, 20: 43193

**ARGONNE ADVANCED RESEARCH REACTOR**
- reactivity measurements in, 20: 45106(R) (ANL-7249)

**ARGONNE BIOLOGICAL RESEARCH REACTOR**
- dosimetry for exposure rooms of, fast-neutron and $\gamma$, 20: 43668(R) (ANL-7136, pp 1-16)

**ARIZONA**
- igneous rocks in, age estimation of, 20: 43502(R) (COO-689-60, App.A-2)
- metamorphic rocks in, age estimation of, 20: 43501(R) (COO-689-60, App.A-1)
- mica and feldspar in, age estimation of, 20: 43503(R) (COO-689-60, App.A-3)
- ore deposits in, geological studies of, 20: 43500(R) (COO-689-60)
- volcanic rocks in, geological studies of, 20: 43500(R) (COO-689-60)

**ARSENIC**
- determination by charged-particle reactions at 2 Mev, 20: 43097
- determination in powder samples by spectrographic methods, semiquantitative, 20: 43104
- separation from other elements by ion exchange using triisoöctylamine, 20: 43439

**ARSENIC IONS**
- charged distribution of 10- to 70-Mev stripped, 20: 44136

**ARSENIC ISOTOPES As-76**
- content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)

**ARSENIC ISOTOPES As-77**
- yields of, from neutron reactions with germanium-76, 20: 44816

**ARSENIC OXIDES**
- effects on radioinduced coloration of, borate glass, 20: 44010

**ARSENITE IONS**
- electron spin resonance spectra of, in gamma-irradiated calcite crystals, (E), 20: 45010

**ASBESTOS**
- asbestos–cellulose, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)
- asbestos–cellulose, thermal stability of filters of, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)

**ASCORBIC ACID**
- radiation effects on content of, in potatoes, 20: 43773

**ASPARTIALDEHYDIC ACID**
- labeling with carbon-14, using labeled sodium cyanide and ethyl malonate, 20: 43273

**ASTROPHYSICS**
- appearance of relativistically expanding ratio sources, 20: 44083
- book: *Nuclear Chemistry*, 20: 43056(T) (JPRS-36943)
- gravitational collapse of quasars, irreversibility of, 20: 44082
- nucleosynthesis abundance calculations for, mass low dependence on, 20: 44070 (LA-DC-7885)

**ATHEROSCLEROSIS**
- radiation effects on development of fatty acid peroxide-induced, in rabbit and rat aorta, 20: 42813

**ATLANTIC OCEAN**
- cesium-137 and strontium-90 content in, and adjoining seas, 1963-64, 20: 43540
- strontium-90 content of, evaluation of total, 20: 43517(T) (AEC-tr-6798, Paper 2)
- strontium-90 content and diffusion in, 20: 43541
- strontium-90 distribution on surface of, compared to Indian and Pacific Oceans, 20: 43516(T) (AEC-tr-6798, Paper 1)

**ATMOSPHERE**
- cesium-137 content in Chicago, Ill., 1965, 20: 43512(R) (ANL-7136, pp 315-27)
- contamination in Japan with niobium-95 and zirconium-95, 1961–64, 20: 43615
- cosmic-ray nuclei in, flux and energy spectrum of low-energy heavy, (E), 20: 44458
- effects of movement on climate, 20: 43505(R) (COO-689-60, App.A-5)
- electron precipitation into, energy variation of, (T), 20: 44474
- fission products in upper, distribution of, 20: 43524
- ionization by cosmic radiation at sea level, (E), 20: 44456
- maximum permissible limits for beryllium in, 20: 42755
- model for large-scale circulation in thermosphere, 20: 44465
- modification of, effects of nuclear detonations on, 20: 43510 (RM-4989-TAB)
- monitoring near beryllium production plants, 20: 43629
- monitoring of uranium mine, 20: 43594(T) (AEC-tr-6763)
- neutron background in, 20: 43547
- neutron background in, effect of cosmic radiation on, 20: 43547
- radiation effects on primitive Earth, formation of sulfur-containing amino acids in electron, 20: 42726
- radiation monitoring of, at Savannah River Plant, January to June 1966, 20: 43577(R) (DPST-66-30-2)
- radioactivity of Universitaria Island, Brazil, 1963 and 1964, 20: 43548
- radon-220 content below 50 cm in, 20: 43543
- Rayleigh scattering in, scalar transfer functions for, 20: 44075
- spectra of, route dependence of gravitational red shift, 20: 44490

**ATOMIC ENERGY**
- industry in Canada, general survey, 20: 45102 (66-CNA-320)
- regulations on shipment of radioactive materials, 20: 43492 (ORNL-TM-1312(Vol.2))
- role of medical examinations in Italy, 20: 43600

**ATOMIC ENERGY COMMISSION**
- support of study on mortality of contractor employees, 20: 42865

**ATOMIC EXPLOSIONS**
- acoustic-gravity waves in ionosphere from, 20: 44448
- bibliography on studies of survivors of, 20: 42696 (ABCC-9-65)
- debris distribution from, method for determination of, 20: 43524
- effect on clays and soils, 20: 43607
- effects of exposure to Hiroshima, on development of psychotic syndromes, 20: 42924
- effects of Project Sedan, on lizard populations, 20: 42732
- effects on beta activity measurements in plankton in Adriatic and Ligurian Seas, 20: 43536
- effects on health of populations of Hiroshima and Nagasaki, 20: 42827(R) (ABCC-58-59)
- effects on health of populations of Hiroshima and Nagasaki, 20: 42828(R) (ABCC-59-60)
- effects on mortality and occurrence of diseases in Japanese survivors, 20: 42697 (ABCC-18-65)
- effects on weather and climate, 20: 43510 (RM-4989-TAB)
- fallout fractionation patterns for Chinese and Russian, 20: 43528
- fission product release by, and resulting contamination of biological materials, 20: 43596
- iodine-131 from Chinese, sampling near Brookhaven, 20: 43608
- seismic wave propagation from underground, 20: 43551 (VUF-3015)
- shock waves from, effects on underground structures, 20: 43495(R) (AD-628806)
- sodium-22 and production by, 20: 43546

**ATOMIC STRUCTURE**
- measurements of, preparation of iron-55 radiation source for, 20: 43384

**ATOMIC WEAPONS**
- blast and thermal radiation from, effects on biological systems, 20: 42710 (TID-23348)
- fallout from testing of, by Chinese on May 9, 1966, 20: 43577(R) (DPST-66-30-2)

**ATOMS**
- electron and positron scattering by, calculations for, 20: 44108(R) (AD-630172)
- electron reactions with, empirical formula for ionization cross sections for, 20: 44110 (IPP-1/50)
- energy levels of, distribution function for distances between, 20: 44130(T)
- gamma coherent scattering at small angles, incoherent component in, (E/T), 20: 44147
- interactions with atoms, cross sections for, 20: 44146
- ionization in varying electric fields, (T), 20: 44151
- neutron scattering on, van Hove equation for thermal, 20: 44593
- reactions with atoms, device for studying forces of, 20: 44145

**AUDITORY ORGANS**
- radiosensitivity of vestibular apparatus in rabbit, alpha, 20: 42858(R) (UCRL-16246, pp 74-83)

**AURINTRICARBOXYLIC ACID**
- use for therapy of beryllium disease in animals, 20: 42754

**AURORAL STORMS**

electron energy spectra and angular distributions in, (E), 20: 44441
electron flux in, electron spectrometer for determining, 20: 43667 (AD-639694)
microbursts following geomagnetic storms and magnetic bays, 20: 44453
occurrence of, correlations with geomagnetic storms, 20: 44477
occurrence, thermosphere energetics related to, 20: 44465
proton and electron flux in, anticorrelations between, (E), 20: 44442
proton angular distributions in, (E), 20: 44442

**AUSTENITE**
production in PM 24 steel, 20: 43891 (EURAEC-1686)

**AUTOPSIES**
factors affecting frequency of, in survivors of Japanese atomic disasters, 20: 42697 (ABCC-18-65)

**AUTORADIOGRAPHY**
electron microscopic, of microorganisms, 20: 42701(R) (ANL-7136, pp 205-30)
localization of lung neoplasms by bronchial, compared with other diagnostic methods, 20: 43037
lymphoid cell function studies in dogs, 20: 42784
techniques for use with short-lived nuclides, 20: 43022
use of lymphatic, for determining injuries to lymph systems from cancer radiotherapy, 20: 42976
use of, in conjunction with scintigraphy for liver diagnosis, 20: 43036

**AUXINS**
effects on geotropism of plants and seedlings, 20: 42703(R) (ANL-7136, pp 302-14)
synthesis by rat tissues, 20: 42835(R) (ANL-7136, pp 63-80)

**AVR REACTOR**
construction and financing, 20: 45131
coolant purification system for, description of, 20: 45142
cooling system for, description of blowers in, 20: 45141
description of, 20: 45133
description of, 20: 45134
design and construction of, 20: 45132
development, 20: 45129
development, 20: 45130
development of, component testing procedures for, 20: 45146
development of, history of, 20: 45131
fuel element fabrication and testing for, 20: 45135
loading device for, description and operation of, 20: 45139
loading equipment for, measurement and control devices for, 20: 45140
neutron physics calculations for, 20: 45144
pressure vessel description, 20: 45136
safety devices for, 20: 45143
shutdown of, operation of equipment for, 20: 45138
startup program for, 20: 45145
steam generator design and construction, 20: 45137

**AZELAIC ACID, ESTER POLYMERS**
radiation effects on physicochemical properties of, 20: 43343

**1-AZIRIDINECARBOXAMIDE, *N,N′*-TETRAMETHYLENEBIS-**
use as chemosterilant for screw-worm flies, comparison with γ irradiation, 20: 42724

**AZO DYES**
solubility of, in heavy water, isotope effects on role of hydrogen bonds in, 20: 43287

**AZOBENZENE**
4′-nitro-2,4-dihydroxy-, solubility of, in heavy water, isotope effects on role of hydrogen bonds in, 20: 43287

**AZOETHANE, 1,1′-DIPHENYL-**
thermal decomposition of deuterated and normal, in ethylbenzene, cage and secondary isotope effects in, 20: 43278

## B

**BACTEREMIA**
etiology of, associated with radiation sickness, 20: 43052

**BACTERIA**
control of pathogenic, in laboratory mice, 20: 42699(R) (ANL-7136, pp 94-108)
effects of Mexaform S on intestinal, 20: 42994
photosensitivity of *Myxococcus xanthus*, 20: 42842(R) (ANL-7136, pp 290-301)
radiation effects on ESR spectra of, effects of cysteamine on γ, 20: 42802
radiation effects on amino acid synthesis by *Micrococcus glutamicus*, fast-neutron and γ, 20: 42914
radiation effects of food-spoilage, on fruits and vegetables, 20: 43781
radiation effects on assays of, on fish fillets following refrigerated storage, gamma, 20: 43793
radiation effects on, in fish, gamma, 20: 43770
role of *Pasteurella pestis* in plague epidemiology, 20: 43587 (RM-4968-TAB)
sulfur metabolism in *Rhodospirellum rubrum*, 20: 42850(R) (NYO-2043-130)
ultraviolet radiation effects on oxidative phosphorylation in *Mycobacterium phlei*, 20: 42810

**BACTERIOPHAGES**
lysogenic induction of *E. coli* K12 λ, formation of new circular DNA species following, 20: 42721
production by *Escherichia coli* during space flight, 20: 42912
radioinduced induction of, in *E. coli* during space flight, cosmic, 20: 42910
radioinduced induction of, in *E. coli* treated with β-mercaptopropylamine, cosmic, 20: 42911
single-strand breaks in DNA of coliphage T7, 20: 42715(R) (UCRL-16246, pp 145-55)

**BARBITURIC ACIDS**
protective effects of sodium amytal in rats, correlation with effects on oxygen content of spleen, 20: 43008

**BARIUM**
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
separation from calcium, cesium, and strontium by ion exchange using heated Dowex column, 20: 43436
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)

**BARIUM CHLORIDES**
sorption by glass, tracer studies of kinetics of, 20: 43251

**BARIUM IONS**
reactions with stearate–stearic acid films, tracer studies of, 20: 43238

**BARIUM ISOTOPES Ba-131**
determination in neutron-irradiated clays and soils, 20: 43607

**BARIUM ISOTOPES Ba-133**
gamma spectra, 20: 44634(R) (IDO-17188)
preparation of high-specific-activity, 20: 43398
use in calibration of thyroid radioiodine uptake measurements, 20: 43031

**BARIUM ISOTOPES Ba-137**
half life of isomeric, (E), 20: 44712

**BARIUM ISOTOPES Ba-140**
content in nuclear debris over Sweden, 1962 to 1963, 20: 43524
incorporation in stearate–stearic acid solutions, 20: 43238

**BARIUM TITANATES**
radiation effects on Curie point and phase transformation points in, neutron, (E/T), 20: 45034

**BARLEY**
calcium uptake and distribution in, relation to strontium-90, 20: 42766
radiosensitivity of altitude effects on γ, 20: 42894
radiosensitivity of dominant and recessive genotypes in desynaptic mutants of, x, 20: 42923
strontium-90 uptake and distribution in, relation to calcium, 20: 42766

**BARYONS**
currents in structure model, form factors of, (T), 20: 44352
decays of, SU(3) theory of strong, 20: 44331
energy levels of, individual-particle approximation of higher-excited, (T), 20: 44220
excitation states of, perturbation calculation of rotational, 20: 44219
form factors of $\frac{1}{2}^+$, electromagnetic, (T), 20: 44214
interactions of $\frac{1}{2}^+$, with leptons, form factors for weak, (T), 20: 44215
interactions of, universality of strong, 20: 44375
interactions with mesons, quark model for coupling constant relations for, 20: 44221
interactions with leptons and photons, $\frac{1}{2}^+$ baryon currents from, (T), 20: 44350
mass formula from current algebra for, 20: 44328
masses of, empirical relations between, 20: 44299
matrix elements of $\frac{3}{2}^+ \to \frac{1}{2}^+$ currents of, in covariant structure model, (T), 20: 44351
properties of, saturation of $SU(6)_W$ algebra for, 20: 44358
sum rules from algebra of current densities for spin-$\frac{1}{2}$, 20: 44326
symmetry for, dynamical models and mass formulas for resonance multiplets in, 20: 44370

**BARYONS, RESONANCE**
classification of $Y_0^*$ (1520) and $Y_1^*$ (1765), in 1134 representation of SU(6), 20: 44258
composite model for, 20: 44365
decay angular distribution of $N^{*++}$, from meson ($\pi^+$)-proton interactions at 8 Bev/c, (E), 20: 44226
decay of $N^{*+}$, covariant field theory of $\gamma + p$, 20: 44216
interactions of, effect of strong correlations on weak, (T), 20: 44760
interactions of, universality of strong, 20: 44375
masses of, empirical relations between, 20: 44299
photoproduction of $N^*$ on protons, absorptive corrections for, (T), 20: 44278
photoproduction on nucleons, quark model for, 20: 44239

production and properties as baryon-meson bound states, empirical selection rules for, 20: 44249
production of polarized $N^*$ from neutrino ($\nu_\mu$)-nucleon interactions, (T), 20: 44276
production of $Y_0^*$(1405), in mesons ($K^-$) capture by carbon-12, (E), 20: 44657 (UCRL-16602)
production of $Z^+$, in meson ($K^+$)-proton interactions at 2.26 Bev/c, (E), 20: 44195
production of $Z^+$, in meson ($\pi^+$) interactions with deuterons at 1.2 and 2.8 Bev/c, (E), 20: 44195

**BATTERIES**
design of 625 kJ capacitor, for magnetic field production, 20: 43457
performance of 625-kJ capacitor, for magnetic field production, 20: 43458

**BAUXITE**
prospecting for, by neutron activation well-logging, 20: 43554

**BEANS**
chloroplast-containing fractions in leaves of, amino acid uptake by proteins in, 20: 42706(R) (NYO-2373-1)
effects of space flight on chromosome aberrations in roots of, 20: 42909
radiation effects on mutagenesis in dry *Vicia faba* seeds, x, 20: 42920
radiation effects on meiosis in *Vicia faba*, x, 20: 42921
radiation effects on, protective effects of inert gases and low molecular narcotics on x, 20: 43007
radioinduced chromosome breaks in *Vicia faba*, effects of dinitrophenol on, 20: 42913
radioinduced mutations of, $\gamma$, 20: 42850(R) (NYO-2043-130)

**BEARING MATERIALS**
wear and corrosion testing in water, for reactor use, 20: 43823 (AECL-2566)

**BEARINGS**
performance of gas-lubricated, under subsonic flow conditions, 20: 43469 (TID-23350)
testing gas-lubricated, for Brayton cycle turbocompressor, 20: 43481(R) (NYO-3237-6)

**BEHAVIOR**
nature of human, in error reduction programs, 20: 45241 (SC-TM-65-135)
radiation effects on, of deer mice, neutron, 20: 42833(R) (ANL-7136, pp 16-46)
radiation effects on conditioned response of pigeons and rats, $\gamma$ and x, 20: 42852(R) (ORO-2903-28)

**BELGIAN REACTOR-3**
performance of, reliability of, 20: 45181

**BELGIUM**
waste disposal and management at Eurochemic Reprocessing Plant, Mol, requirements and problems of, 20: 45232

**BELLOWS**
design for Castle Manipulators, 20: 43069(R) (IDO-14679, pp 51-9)

**BENZALDEHYDE**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZANTHRACENE,DIMETHYL-**
effects of, on mouse skin carcinogenesis in combination with beta and x radiation, 20: 42969

**BENZENE**
analysis for water, isotopic dilution method for, 20: 43113
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
properties as chromatographic developer, 20: 43406
radioinduced production in meats, 20: 42973
radiolysis of, isomerization of stilbene by triplet states from, 20: 43360
solvent properties for fructose, glucose, and sucrose, 20: 43402
solvent properties for antipyrine-salicylate complexes of rare earths, 20: 43256
yields in reactions of cumene on gamma-irradiated silica gels, effects of annealing on, 20: 43319
benzene–bromobenzene, radiation effects of (n,$\gamma$) and (n,2n) reactions in, 20: 43334
benzene–bromoethane, radiation effects of (n,$\gamma$) and (n,2n) reactions in, 20: 43334
benzene–$H_2SO_4$–trioctylamine–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
benzene–didecylamine–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
benzene–didecylamine–$Na_2SO_4$–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, interface and transferring species in, 20: 43424 (ORNL-P-2359)
benzene–thenoyltrifluoroacetone, solvent properties for protactinium, 20: 43431
benzene–toluene, tritium labeling of, 20: 43268

**BENZENE, BROMO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
radiolysis of, use of charged plates in collecting products from neutron, 20: 43367
benzene–bromobenzene, radiation effects of (n,$\gamma$) and (n,2n) reactions in, 20: 43334

**BENZENE, 1-BROMO-4-CHLORO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZENE, CHLORO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZENE, 1-CHLORO-4-IODO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZENE, CHLORONITRO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZENE, DICHLORO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
nuclear magnetic resonance spectra of, comparison of methods for analysis of, 20: 44680

**BENZENE, DINITRO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZENE, ETHYL-**
effects on thermal decomposition of deuterated and normal 1,1′-diphenylazoethane, 20: 43278

**BENZENE, FLUORO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZENE, HEXAFLUORO-**
effects on hydrogen yields in gamma radiolysis of cyclohexane and hexane, 20: 43316

**BENZENE, HEXAKIS(TRIFLUOROMETHYL)-**
carbon-13 and fluorine-19 hyperfine splittings in, effects of temperature on, 20: 43225

**BENZENE, IODO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
radiolysis of, use of charged plates in collecting products from neutron, 20: 43367

**BENZENE, NITRO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
thermal conductivity of, device for measuring, 20: 43270 (AEET-245)

**BENZENEARSONIC ACID**
effects on sorptive properties of activated charcoal for protactinium, 20: 43148

**BENZENEBORONIC ACID**
effects on tissues, 20: 42840(R) (ANL-7136, pp 164-90)

**BENZENETHIOL**
radiolysis of, EPR studies of radicals from electron, 20: 43330

**BENZIL**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313

**BENZODIPYRROL-7,15-DIONE, OXY-2,10-BISBENZIMIDAZO-**
preparation and properties of radiation-resistant, 20: 43286

**BENZOIC ACID**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZOIC ACID, *p*-CHLORO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZOIC ACID, *p*-HYDROXY-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZONITRILE**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZONITRILE, *p*-CHLORO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZONITRILE, *p*-HYDROXY-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZOPHENONE**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318

**BENZOPHENONES**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313

**BENZOQUINONE**
radiolysis of, water elimination reactions in pulse, 20: 43332
spectral studies on oxygen-17-labeled, effects of solvents on ESR, 20: 43224

**BERYLLIUM**
bibliography on, 20: 43627
chemical and physical properties of, 20: 43107
corrosion by flowing water at pH 5 and 100°C, dynamic, 20: 43833 (ORNL-TM-1030)
deformation of single-crystal, microstrain behavior in, 20: 43924
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in biological and industrial materials, methods for, 20: 43108
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
effects on animals, carcinogenic, 20: 42754
electron energy losses at 28.5 Mev in thin foils of, 20: 45003
emissivity of titanate-coated, at high temperatures, 20: 43816(R) (PWA-2877)

expansion of tubular, equipment for measuring, 20: 43960
helium release from irradiated, 20: 45046(R) (IDO-17192)
industrial uses of, review, 20: 43628
maximum permissible limits for air, drinking water, and streams, 20: 42755
mechanical properties of irradiated, 20: 45046(R) (IDO-17192)
medical management of personnel in processing plants, 20: 42756
monitoring in air, 20: 43629
neutron cross sections from 0.037 ev to 18 Mev, tables of, 20: 44661 (UNC-5139)
occupational exposure to, health aspects and cost factors for protective measures, 20: 43628
proton reactions at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
reactions with hydrofluoric acid, heat of formation of beryllium fluoride from, 20: 43269
shipping regulations for, 20: 43629
toxicity in experimental animals, 20: 42754
toxicity in man, 20: 42751
toxicity in man, 20: 42752
toxicity in man, 20: 42753

**BERYLLIUM ALLOYS**
cleaning and surface preparation of, for bonding and plating, 20: 43857 (NASA-TM-X-53453(Vol.4))
forming of methods for aerospace components, 20: 43856 (NASA-TM-X-53453(Vol.2))
heat treatment of, methods for aerospace vehicle structures, 20: 43858 (NASA-TM-X-53453(Vol.5))
joining methods for, technical memorandum on, 20: 43859 (NASA-TM-X-53453(Vol.6))
properties at 1000 to 2100°F, cause and mechanism of, 20: 43886(R) (BBC-111)
Be–Mo, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Be–Nb, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Be–Ta, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Be–Ti, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Be–U, combustion kinetics of, 20: 43612
Be–W, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Be–Zr, properties at 1000 to 2100°F, effects of atmosphere and impurities on, 20: 43886(R) (BBC-111)

**BERYLLIUM COMPOUNDS**
industrial uses of, review, 20: 43628

**BERYLLIUM FLUORIDES**
heat of formation of, use of rotating-bomb calorimeter for determination of, 20: 43269
$BeF_2$–LiF–$ZrF_4$, electrochemical studies of uranium in molten, at 480 to 620°C, 20: 43099

**BERYLLIUM ISOTOPES Be-7**
determination in air-filter samples, radiochemical, 20: 43512(R) (ANL-7136, pp 315-27)
proton reactions (p,γ) at 483 to 1932 kev, cross sections for, (E), 20: 44076

**BERYLLIUM ISOTOPES Be-8**
energy levels from lithium-7 (d,n) reactions (E), 20: 44677

**BERYLLIUM ISOTOPES Be-9**
alpha reactions (α,n) at 4.3 to 12.0 Mev, carbon-13 energy levels from, (E), 20: 44723
deuteron reactions (d,n) at 2.8, 4.0, and 7.0 Mev, boron-10 energy levels from, (E), 20: 44601(R) (ANL-7218)
deuteron reactions (d,n), angular and energy distributions from, 20: 43550(R) (NYO-844-67)
helium-3 reactions (He-3,d) at 10, 17, and 25 Mev, boron-10 energy levels from, (E), 20: 44601(R) (ANL-7218)

**BERYLLIUM ISOTOPES Be-10**
use in age estimations for Pleistocene events, 20: 43557

**BERYLLIUM MODERATED REACTORS**
design of tungsten-based, reflected, for rocket propulsion, 20: 45199

**BERYLLIUM OXIDES**
degassing of, 20: 43815(R) (NASA-CR-54356)
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
pressing techniques for hot, 20: 43863 (Y-1290)
radioinduced swelling in, model of neutron, 20: 43985 (AAEC-TM-318)
BeO–$PuO_2$–$ThO_2$, nuclear parameters of fuel pellets of, 20: 45176
BeO–$ThO_2$–$UO_2$, radiation effects on dispersions of, effects of particle size on, in-reactor, 20: 44014

**BERYLLIUM OXIDES (IMPREGNATED)**
radiation effects on, in-reactor, 20: 44014

**BERYLLIUM POISONING**
diagnosis and etiology of, 20: 42751
diagnosis and etiology of, 20: 42752
diagnosis and pathology of, 20: 42753
therapy, 20: 42754

**BETA DECAY**
beta-particle energies of radioisotopes, tables of maximum, 20: 44655 (SZS-4/66)
energy release in, systematics of, 20: 44821
nuclear reorientation before gamma emission in, (E), 20: 44688

**BETA-DIFFRACTION ANALYSIS**
use for determination of contents of ternary systems, 20: 43120

**BETA PARTICLES**
activity in air in West Germany, 20: 43626
counting for radon determination, 20: 43525
detection and measurement in waste solutions, method for absolute, 20: 43072(R) (IDO-14679, pp 193-229)
detection and measurement of gross activity of, in waste solutions, 20: 43072(R) (IDO-14679, pp 193-229)
detection and measurement in river water, comparison, 20: 43601
detection and measurement in reactor cooling water, 20: 43688
detection and measurement in solutions using G-M counter, 20: 43697
detection and measurement of, design of low-noise anticoincidence counters for, 20: 43719
determination of activity of, in rainwater in New Zealand from 1956 to 1959, 20: 43530
dosimetry of, from deposited potassium-40 in man and sheep, 20: 42940
dosimetry of, in labeled compounds and non-beta-emitting radionuclides, 20: 43051
effect of self-generated, on isotopic exchange of tritium with toluene, 20: 43268
effects of sulfur-35, on growth of rice plants, 20: 42949
effects of yttrium-90, on specific lymphopenia induction in dogs, 20: 42902
effects on animals, lethal, 20: 42934
effects on blood serum proteins in dogs following intraarterial exposure, 20: 43013(R) (ORO-2459-1)
effects on crystal lattices, 20: 43987 (BNL-10569)
effects on erythropoietic index and iron content in man, 20: 42908
effects on human and rat thyroids, 20: 42857(R) (TID-23228)
effects on lymphatic dynamics, lymph nodes, and lymph vessels following cancer therapy, 20: 42976
effects on mice, carcinogenic, 20: 42840(R) (ANL-7136, pp 164-90)
effects on mouse skin carcinogenesis induced by dimethylbenzanthracene, synergism of, 20: 42969
effects on rat leukocytes of, from internally deposited phosphorus-32, 20: 42948
effects on surface of molybdenum oxide, (E), 20: 44026(T)
emission from electrostatically collected decay products of polonium-216, 20: 43387
energy spectra and polarization from neutron decay in external magnetic field, (T), 20: 44274
measurement of activity in atmosphere from, 20: 43577(R) (DPST-66-30-2)
radiation dose to tissues from, emitted by insoluble and soluble strontium-90, 20: 43631
radioactivity in plankton samples from Adriatic and Ligurian Seas, 20: 43536
RBE for human body, 20: 42865
reflection of, to determine concentrations of copper sulfate solutions, 20: 43142
response of moth eye to, 20: 42852(R) (ORO-2903-28)
use for therapy of skin metastases, 20: 43039
use in therapy of acute leukemia, 20: 43045

**BETA SOURCES**
design of radiosterilization device using promethium-147, 20: 43796(P)
effects of implanted, in rats, carcinogenic, 20: 42840(R) (ANL-7136, pp 164-90)
preparation of thallium-204, 20: 43400
uptake by soils from rain, Switzerland, 1963, 20: 43519
use in argon-ionization, helium-electron capture detector for gas chromatography, 20: 43156
use of Kryptonate, in materials research, 20: 43765
use of yttrium-90 for intraarterial blood exposure, 20: 43013(R) (ORO-2459-1)

**BETA SPECTROMETERS**
design and construction of low-energy, high-resolution, 20: 43288(R) (CALT-532-1)
design and performance of 4π, with liquid scintillator for low specific activity samples, 20: 43682
design for auroral research, 20: 43667 (AD-639694)
scattering chamber for, design of, 20: 43288(R) (CALT-532-1)

**BETATRONS**
beam collimator for high-energy, effects on energy spectrum, 20: 43040
use in therapy, radiation protection of patients during, 20: 43012 (BMwF-FBK-66-03)

**BETTIS ATOMIC POWER LABORATORY, PITTSBURGH**
environs monitoring, 1966, 20: 43586 (PNRO-DEV-136)

**BEZNAU POWER REACTOR**
pressure vessel fabrication for, 20: 45167

**BIBLIOGRAPHIES**
beryllium physical and chemical properties, 20: 43107
on basic research performed under auspicies of Atomic Bomb Casualty Commission, 20: 42696 (ABCC-0-65)
on beryllium, 20: 43627
on carbon-14 age estimation, 1966, 20: 43560
on chemistry of oxygen-containing cations of transition metal, 20: 43190
on chemistry of transplutonic elements, 20: 43055 (STI-PUB-21/19)
on cross sections of neutron reactions with charged-particle emission, 20: 44671(T) (INDSWG-101, pp 164-223)
on decontamination methods and equipment, 20: 43569 (AED-C-13-04)
on determination of antimony in natural materials by neutron activation, 20: 43080 (ORO-2670-15)
on high-temperature chemistry and physics of condensed materials, 20: 43903 (NP-16238)
on neutron poisons, 20: 45080
on nuclear techniques in forensic science, 20: 43082 (PEL-116)
on physical properties and phase diagrams of refractory oxides, 20: 43911 (UCRL-6262(Pt.1))
on plutonium, 20: 45236 (BNWL-113-17)
on plutonium, 20: 45237 (BNWL-113-18)
on production and industrial uses of radioisotopes, 20: 43757 (ORNL-TM-1505(Pt.2))
on properties of tellurium and its fluorine and oxygen compounds, 20: 43164 (ANL-7142)
on radiation detection and protection in Soviet Union, 20: 43666 (AD-623557)
on radiochemistry of plutonium, 20: 43076 (NAS-NS-3058)
on radiophotoluminescence dosimetry, 20: 43689
on radiosensitivity of animals and plants, 20: 42849 (NP-16258)
on studies of atomic bomb survivors, 20: 42696 (ABCC-0-65)
on thermal-neutron-induced reactions with charged-particle emission, 20: 44666(T) (INDSWG-101, pp 1-22)
on x-ray fluorescence analysis, 20: 43058 (AERE-Bib-136(Pt.2))

**BIOCHEMISTRY**
abstracts of studies on, 20: 42719(R) (UR-49-687, pp 117-31)
radiation effects on, of stored fruits and berries, gamma, 20: 43782

**BIOLOGICAL MATERIALS**
analysis for beryllium, methods for, 20: 43108
analysis for carbon-14, phosphorus-32, sulfur-35, and tritium by liquid scintillation counting, 20: 43128
analysis for carbon-14 or tritium by scintillation counting, combustion method for, 20: 43139
contamination by fission products from nuclear detonations, 20: 43596
growth of marine, on strontium-85-labeled strontium titanate pellets, 20: 43592 (USNRDL-TR-1042)
radioactivity of, near Andujar uranium installation, 20: 43001
uranium content in, radiochemical determination by electrodeposition, 20: 43405

**BIOLOGICAL MODELS**
development for chromosome function and structure, 20: 45243 (UCRL-14625(Rev.1))
development of mathematical, for cell population growth studies, 20: 42838(R) (ANL-7136, pp 140-54)
evaluation of compartment, for bone metabolism studies, 20: 42744(R) (UCRL-16246, pp 19-35)
use for radiation effects studies on hematopoietic system of mammals, 20: 42844 (BNL-10385)

**BIOLOGICAL STRESS**
induction by pressurized suits, formula for predicting, 20: 43571 (AHSB(RP)-70)

**BIOLOGICAL SYSTEMS**
data on, computer analysis of, 20: 42698(R) (ANL-7136, pp 80-94)
injuries to, from nuclear blast and thermal radiation, 20: 42710 (TID-23348)

**BIOLOGICAL WARFARE**
hazards of, to U.S. populations, 20: 43566 (AD-625251)

**BIOLOGY**
research programs at Chalk River on, 20: 45234 (AECL-2460)
research reactor uses in, 20: 45206 (ORO-3191-1)

**BIOMETRY**
analysis of population mortality data, 20: 42698(R) (ANL-7136, pp 80-94)
calculation of strontium-90 concentration in bones on basis of power function of strontium retention, 20: 43619
formulae for predicting thermal stress caused by pressurized suits, 20: 43571 (AHSB(RP)-R-70)
mathematical model of radiation injury recovery in animals, 20: 42829 (AD-635167)

**BIOSYNTHESIS**
enzyme reactions in methionine, propionate, erythritol, protein, and sterol, 20: 42737(R) (ANL-7136, pp 231-42)
radiation effects on DNA and RNA, in *Paramecium caudatum*, uv, 20: 42800(T) (ORNL-tr-1289)

**BIPHENYL**
performance as working fluid in Rankine cycle, 20: 43497(R) (SAN-651-1)
radiation effects on alcohol solutions of, spectral studies on gamma, 20: 43314
thermal conductivity of, device for measuring, 20: 43270 (AEET-245)
biphenyl–biphenyl ether, performance as working fluid in Rankine cycle, 20: 43497(R) (SAN-651-1)

**BIPHENYL, ISOPROPYL-**
thermal conductivity of, device for measuring, 20: 43270 (AEET-245)

**BIPYRIDINES**
complexes with cobalt, radiation effects on, role of water of hydration in thermal annealing of, 20: 43366
complexes with lanthanum, preparation and properties of, 20: 43259
complexes with yttrium, preparation and properties of, 20: 43258

**BIRDS**
radiation effects on conditioned response of pigeons, x, 20: 42852(R) (ORO-2903-28)

**BISMUTH**
determination in iron meteorites by slow-neutron activation, 20: 43550(R) (NYO-844-67)
determination in ocean deposits, 20: 43550(R) (NYO-844-67)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
effects on determination of radium-228 by ion exchange and actinium-228 counting, 20: 43442
electric conductivity of liquid, to 1600°K, 20: 43179(R) (NYO-2082-6)
electron elastic scattering at 52.9 Mev, cross sections for, (E), 20: 44771
proton reactions at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
reactions of liquid, with tungsten to 2024°K, 20: 43179(R) (NYO-2082-6)
sorption by ceric iodates, 20: 43448

**BISMUTH ALLOYS**
Bi–Ag, superconductivity, 20: 44554
Bi–Co, superconductivity, 20: 44554
Bi–Cu, superconductivity, 20: 44554
Bi–Ir, superconductivity, 20: 44554
Bi–Mg, superconductivity, 20: 44554
Bi–Mo, superconductivity, 20: 44554
Bi–Pb, effects of copper plating on magnetization and susceptibility at 4.2°K, 20: 44530
Bi–Pb, magnetic flux retention in hysteretic superconducting, 20: 44521
Bi–Pb, superconducting transition temperatures of, 20: 44515
Bi–Re, superconductivity, 20: 44554
Bi–Ru, superconductivity, 20: 44554
Bi–Sn, machining procedures for, 20: 43864 (Y-1550)
Bi–Sn, superconductivity, 20: 44554
Bi–U, combustion kinetics of, 20: 43612
Bi–Zn, superconductivity, 20: 44554
Bi–Zr, superconductivity, 20: 44554

**BISMUTH IODATES**
sorptive properties for actinides and lanthanides, 20: 43448

**BISMUTH IODIDES**
formation during beta-decay of lead-210 in triphenyllead iodides, 20: 43406

**BISMUTH ISOTOPES Bi-210**
energy levels from beta decay of polonium-210, (E), 20: 44831
formation during beta-decay of lead-210 in triphenyllead iodides, 20: 43406
incorporation in tetrahydrated ammonium cerium sulfates, mixed crystal formation in, 20: 43252

**BISMUTH ISOTOPES Bi-214**
measurement in uranium mine air filters, 20: 43594(T) (AEC-tr-6763)

**BISMUTH SYSTEMS**
Bi–Te, superconductivity, 20: 44554

**BLACK SEA**
cesium-137 and strontium-90 content in, 1963-64, 20: 43540
fission product content in surface waters of, 1960–1964, 20: 45227
radioactive contamination of, band on strontium-90 diffusion, 20: 43539

**BLADDER**
radiodiagnosis and radiotherapy of ulcers, 20: 42796

**BLAST EFFECTS**
hazards of, to populations during nuclear wars, 20: 43566 (AD-625251)
hazards to biological systems from, 20: 42710 (TID-23348)

**BLOOD**
distribution of cesium and rubidium in human, 20: 42778
histamine content in guinea pig, after injection of cysteamine, 20: 42982
lymphoid cells of, autoradiographic studies of functions of, 20: 42784
morphology of, relation to iron content of body, 20: 42908
radiation effects on metabolism in rat peripheral, x, 20: 42788
radiation effects on serum proteins from intraarterial exposure, $\beta$, 20: 43013(R) (ORO-2459-1)

radiation effects on, ionizing whole-body, 20: 42822
radiation effects on content of residual nitrogen, urea nitrogen, and amino acid nitrogen in dog, x, 20: 42939
radiation effects on, from exchange transfusion in rats, whole-body x, 20: 42955
radiation effects on, in mice centrifuged prior to gamma or proton exposure, 20: 42985
radioinduced chromosome aberrations in leukocytes of human peripheral, 20: 42931
radiosensitivity of proliferating cells in, 20: 42845 (CONF-660543-1)
BLOOD CIRCULATION
coronary, rubidium-86 uptake and distribution and mechanisms involved, in dogs, 20: 42749
effects of dipyridamole on coronary, in dogs, tritiated water tracer for, 20: 42763
radiation effects on micro, in rat bone marrow, x, 20: 42871
radioinduced hemostasis in microcirculation of rat mesentery, response to serotonin following x, 20: 42978
radioisotope studies of function in, 20: 43051
BLOOD FORMATION
mechanism for chemical radiation protection by imidazole derivatives based on stimulation of, 20: 42979
physiology of leukocyte formation and regulation, 20: 42708(R) (TID-22931)
radiation effects on, 20: 42845 (CONF-660543-1)
radiation effects on, in rats treated with bone marrow transplants, x, 20: 42956
BLOOD PLASMA
distribution of cesium and rubidium in human, 20: 42778
lipoproteins in human, particle-size distribution of low density, 20: 42717(R) (UCRL-16246, pp 176-85)
radioactivity in human, following ingestion of iodine-131-labeled triolein, 20: 42782
sodium chloride content and osmotic concentration in irradiated fish transferred from fresh to salt water, 20: 42885
strontium-90 concentration in, of beagles on chronic ingestion regimen of the radionuclide, 20: 42780
BLOOD PLATELETS
content in dogs, effects of typhoid-paratyphoid vaccine on, 20: 42987
radiosensitivity effects on lethally irradiated monkeys in combination with antibiotics and blood platelets, 20: 42980
BLOOD SERUM
analysis of, for calcium-45 by liquid scintillation counting, 20: 43117
chemical structure of phospholipids of, 20: 42743 (UCRL-14631)
effects of microwave exposure on proteins in man and rabbit, 20: 42876
iodine-125 and -127 metabolism by rat, effects of simulated altitude on, 20: 42745(R) (UCRL-16246, pp 126-37)
ion binding properties of lipoproteins in human, 20: 42743 (UCRL-14631)
labeling albumin of, with iodine-131, 20: 43397
radiation dose to man following inhalation of iodine-131- or isomeric technetium-99-labeled albumins in, 20: 42797
radiation effects on proteins of frog, gamma, 20: 42787
radiation effects on electrophoretic distribution of glycoproteins in, of hyperthyroid rats, x, 20: 42805
radiation effects on properdin, denaturation by ultraviolet, 20: 42823
radiation effects on esterase activity in rat, x, 20: 42824
radiation effects on protein fractions in rabbits, x, 20: 42870
radiation effects on bactericidal activity of, effects of mercamine on, 20: 43003
radioiodination of soluble proteins in rabbit and rat, using chloramine T, 20: 43274
zinc-65 distribution in protein fractions of guinea-pig serum, 20: 42791
BLOOD TRANSFUSIONS
effects of exchange, during whole-body lethal x irradiation of rats, 20: 42955
radiosensitivity effects on whole-body irradiated rats, x, 20: 42788
BLOOD VESSELS
effects of yttrium-90 implants in dog aorta on specific lymphopenia induction, 20: 42902
radiation effects on aorta, of rabbits and rats, 20: 42813
radiation effects on rabbit brain, $\gamma$ and x, 20: 42862
radiation effects on activity in femoral and portal vein, in rabbits following duodenal injection of carbon-14-labeled L-alanine, $\gamma$, 20: 42972
radiography of renal, using lipiodol, 20: 43024
rubidium-86 distribution in dog coronary, circulatory mechanisms involved in, 20: 42749
BLOOD VOLUME
apparatus and method for determination of, 20: 43054(P)
BODY FLUIDS
analysis of, for calcium-45 by liquid scintillation counting, 20: 43117
regulation in fish, effects of x radiation on osmo-, 20: 42885
BOILERS
design and fabrication of AVR steam generator, 20: 45137
design for organic Rankine cycle working fluid, 20: 43497(R) (SAN-651-1)
heat transfer analysis in reactors, temperature-enthalpy diagram for, 20: 45174
leaks in sodium-heated, method for detection of, 20: 45059
BOILING
burnout heat flux in, effect of inlet flow conditions on, 20: 43478 (EURAEC-1620)
heat transfer in subcooled nucleate, of orthoterphenyl, 20: 43486
BOILING REACTOR EXPERIMENTS
reactivity characteristics of BORAX-V, 20: 45202 (ANL-6964)
BOILING REACTORS
coolant dynamics in natural circulation, computer program for, 20: 43479 (JAERI-1108)
fuels for, supply in 1970–1985 period, 20: 45118 (RISO-M-434)
kinetics of, computer program for nuclear, thermal, and hydraulic, 20: 45074 (JAERI-1107)
operation of, public health evaluation of hazards from, 20: 43632
pressure vessel for 1000 Mw(e), design of prestressed concrete, 20: 45109(R) (EURAEC-1673)
BOLOMETERS
use in spin magnetic resonance detection, (E/T), 20: 45007
BONDING
methods for beryllium alloy aerospace vehicle components, 20: 43859 (NASA-TM-X-53453(Vol.6))
BONDS
peptide, gamma-induced radiolysis in polyamino acids, 20: 42826
BONE MARROW
effects of heterologous and isologous injections of, on immune reactions and metabolism in mice, 20: 42854(R) (TID-23127)
effects of transfusions on protein fractions in serum of irradiated rabbits, 20: 42870
immunologically competent cells in, theoretical elimination of, 20: 42705 (BNL-10405)
injuries to cell nuclei in mouse, from x rays in combination with acceleration or vibrations, 20: 42986
lymphoid cells of, autoradiographic studies of functions of, 20: 42784
proliferation in man, time parameters of, 20: 42705 (BNL-10405)
radiation dose to, from medical exposure, $\gamma$, 20: 43620
radiation effects on metabolism in rat, x, 20: 42788
radiation effects on stem cells in mammals, x, 20: 42844 (BNL-10385)
radiation effects on, ionizing whole-body, 20: 42822
radiation effects on stem cell content in mouse, x, 20: 42831 (AD-635600)
radiation effects on rat, kinetics of hemopoietic regeneration following x, 20: 42871
radiation effects on mitosis in erythroblasts of human, chronic low-level, 20: 42884
radiation effects on cells of, in mice injected with 5-methoxytryptamine and cystamine, 20: 42938
radiation effects on rat, whole-body lethal x, 20: 42955
radiation injuries to, in experimental animals following subcutaneous injection of radionuclides, 20: 42967
radioinduced chromosome aberrations in rats, dose effects, 20: 42951
radioprotective effects of injected isologous, against proton effects on mice, 20: 42981
radiosensitivity effects on lethally irradiated monkeys in combination with antibiotics and blood platelets, 20: 42980
radiosensitivity effects on secondary disease in mice, effects of donor treatment with alkylating agents and cortisone on, 20: 42995
radiosensitivity of, 20: 42845 (CONF-660543-1)
radiosensitivity of, 20: 42865
radiosensitivity of, in man and monkeys, 20: 42934
role in lymphoid regeneration in mice, 20: 42984
therapeutic effects of transplantation in lethally irradiated rats, 20: 42956
transplantation of radiation-chimera, immunology of, 20: 42730
uptake of iron-59 in rat, effects on erythropoiesis, 20: 42957
use in therapy of acute leukemia, 20: 43045
BONE TUMORS
induced by beryllium in animals, 20: 42754
BONES
analysis of ash of, for strontium-90, method for, 20: 43061 (CEA-R-2998)
calcium-47 metabolism in human, whole-body counting methods for determining, 20: 42744(R) (UCRL-16246, pp 19-35)
cesium-137 content in human, in Moscow, 1961 to 1964, 20: 42741 (NP-16265)
evaluation of radiotherapy for metastatic involvement in, 20: 43038
formation from cartilage of, biochemical study of, 20: 42997(R) (ANL-7136, pp 191-204)
lead-210 and polonium-210 content in tissues of cigarette smokers, comparison with non-smokers, 20: 42952
lead-210/strontium-90 correlations in human, 20: 42781
measurement of calcium metabolism in human, using radioisotope tracers

and whole-body counters, 20: 42764
mineralization status of, radiographic instruments for, 20: 43049
radiation dose to rodent, in Minas Gerais, Brazil, 20: 43606
radiation dosimetry in dog and human, using lithium fluoride thermoluminescent dosimeters, γ and x, 20: 43747
radiation effects on metabolism of, following localized radiation injuries, x, 20: 42785
radioactivity contained in, of experimental animals following subcutaneous injection of radionuclides, 20: 42967
radiographic density measurements, instrument for gamma, 20: 43049
radioisotope scanning techniques for, 20: 43051
radiotherapy of skin metastases arising from neoplasms in, 20: 43039
radiotherapy of spondylitis and tuberculosis of, radium-224, 20: 43046
strontium-85 metabolism in human, whole-body counting methods for determining, 20: 42744(R) (UCRL-16246, pp 19-35)
strontium-85 retention by, effects of thyroid hormones on, 20: 42769
strontium-90 concentration in, of beagles on chronic ingestion regimen of the radionuclide, 20: 42780
strontium-90 concentration as predicted from retention of single dose of tracer, 20: 43619

**BORATE GLASS**
radioinduced coloration of, effects of arsenic oxide on gamma, 20: 44010
radioinduced coloration of, uses in determining structural changes, 20: 44010

**BORIC ACID**
decontamination effects of, with ultrasonics on rat skin contaminated with $^{131}$I, $^{32}$P, or $^{90}$Sr, 20: 42811
effects on criticality control in zirconium fuel process, 20: 43067(R) (IDO-14679, pp 6-46)

**BORON**
analysis for impurities by x-ray fluorescence, 20: 43091 (UCRL-14879)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in synthetic materials, spectrophotometric curcumin method for, 20: 43067(R) (IDO-14679, pp 6-46)
determination in steel by x-ray spectrochemical methods, 20: 43161
determination in thorium, spectrochemical, 20: 43068(R) (IDO-14679, pp 47-50)
effects on electron spin resonance of polycrystalline graphite, (E), 20: 44008
properties as neutron poison, annotated bibliography on, 20: 45080

**BORON GLASS**
radioinduced production of helium in bulbs of, neutron, 20: 44011

**BORON ISOTOPES B-10**
analysis for impurities in sintered and zone refined, spectrographic, 20: 43090(R) (TID-23342)
crystallization and purification of powders of, methods for, 20: 43090(R) (TID-23342)
energy levels from beryllium-9 (d,n) and (He-3,d) reactions, (E), 20: 44601(R) (ANL-7218)
neutron multiple scattering at 1 to 500 kev in glass phosphors of, Monte Carlo method for studying fast, 20: 43700
neutron reactions (n,α) with, as source of discrepancy in neutron cross-section determinations, 20: 44611 (CONF-660303, pp 486-501)
neutron reactions (n,α) with, cross sections by shell transmission method, 20: 44617 (CONF-660303, pp 701-12)
purification from residues and scrap, methods for, 20: 43090(R) (TID-23342)

**BORON ISOTOPES B-11**
bremsstrahlung reactions (γ,3p) at 250 Mev, helium-8 production and beta decay in, (E), 20: 44726
helium-3 reactions (He-3,p) at 1.23 Mev, carbon-13 energy levels from, (E), 20: 44775
helium-3 reactions (He-3,n), nitrogen-13 energy levels from, (E), 20: 44775
oxygen-16 reactions (O-16, N-15) at 27 to 35 Mev, (E/T), 20: 44757

**BORON NITRIDES**
electric properties as capacitor material, 20: 43815(R) (NASA-CR-54356)
machining procedures for, 20: 43864 (Y-1550)
sorptive properties for iodine, krypton, and xenon, 20: 43067(R) (IDO-14679, pp 6-46)
use in sheathed electric heater, 20: 43465 (AECL-2592)

**BORON SYSTEMS**
B–Mo–Nb–Ti, mechanical and thermal properties of niobium-base systems, 20: 43940
B–Mo–Nb–Ti–Zr, mechanical and thermal properties of niobium-base, 20: 43940
B–Mo–Ni, phase composition and properties of, 20: 43973

**BOROSILICATE GLASS**
radioactive waste fixation in, process at Risö, Denmark for, 20: 45230

**BOSONS**
interactions of spinless, solutions of N/D equations for elastic, 20: 44307
mass levels of, composite model for, 20: 44381
production of pairs of intermediate vector, in photon interactions at high energies, (T), 20: 44277

**BOUNDARY LAYER**
flow at, of flat channel electrically conductive wall, 20: 44406

**BRAIN**
radiation effects on blood vessels in rabbit, γ and x, 20: 42862
radiation effects on innervation system on meninges of dog, 20: 42881
radiation effects on, x, 20: 42925
radiation effects on acetylcholine esterase activity in rat, 20: 42964
radiation effects on rat, protective effects of barbamyl and serotonin on γ, 20: 43008
radioiodination of soluble proteins in rabbit, using chloramine T, 20: 43274
radioisotope scanning techniques for, 20: 43051

**BRASS**
use in G-M counters with activable cathodes, for measurement of fast neutron fluxes, 20: 43729

**BRAZED JOINTS**
cracking of, after metallographic mounting using epoxy resins, 20: 43906 (ORNL-P-2361)

**BRAZIL**
radioactivity in atmosphere at Universitaria Island, 1963 and 1964, 20: 43548
thorium and uranium production at Institute of Atomic Energy of, 20: 43871

**BRAZIL (MINAS GERAIS)**
radiation dose to rodents in, natural, 20: 43606
strontium-90 content of milk in Belo Horizonte, 20: 42999 (NP-15934)

**BRAZING**
operator qualification standards for, 20: 43821

**BRAZING ALLOYS**
radiation effects on type AWS BNi-7, in-reactor, 20: 44027

**BREASTS**
radiotherapy of cancer of, dose-effect curve for pituitary ablation in alpha, 20: 43016(R) (UCRL-16246, pp 58-65)

**BREEDER REACTORS**
development in France, 20: 45157
fuel and fertile stream reprocessing for molten-salt, design study of continuous fluorination-distillation plant for, 20: 43422 (ORNL-3791)
fuel cycle and economics of thorium, 20: 45152
fuel processing for, by aqueous, pyrochemical, and volatility methods, economics of, 20: 43410 (ANL-7137)
prospects of fast, in U. K. nuclear power program, 20: 45179

**BREMSSTRAHLUNG**
effects on ribonuclease activity of liver, 20: 42796
emission from charged particles in Coulomb field, direction of, (T), 20: 44039
emission from theta-pinch plasma, diagnostics from, 20: 44984
production by cosmic nucleons above 500 Mev, 20: 44156
production by electrons at high energies, (E), 20: 44190(T)
production of coherent, by electron reactions with single crystals of silicon at 15 Mev, (E), 20: 45020
production of double, in electron-positron interactions, (T), 20: 44202
reactions (γ,3p) with boron-11 at 250 Mev, helium-8 production and beta decay in, (E), 20: 44726

**BRITISH REACTORS**
development of fast breeder, 20: 45172

**BRITTLE MATERIALS**
strength of sintered, effects of hydrostatic support pressure on ultimate compressive, 20: 43909 (SC-DC-66-1888)

**BROMINE**
content in chondritic meteorites, 20: 44077
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in boron by x-ray fluorescence, 20: 43091 (UCRL-14879)

**BROMINE IONS**
detection of negative, design of scintillation detector for, 20: 43735
effects on gain of electron multiplier tubes, (E), 20: 43659

**BROMINE ISOTOPES Br-82**
exchange between acetyl bromide and tetra-substituted ammonium bromides, 20: 43247
reactions of recoil, formed by neutron irradiation of bromopentammine-rhodium nitrate, 20: 43340

**BROMINE ISOTOPES Br-83**
yields of, from neutron reactions with selenium-82, 20: 44816

**BROMOSULFALEIN SODIUM**
labeling with iodine-131, 20: 43397

**BROOKHAVEN BEAM RESEARCH REACTOR**
description, 20: 45211

**BROOKHAVEN REACTOR**
radioactivity from stock of, 20: 43608

**BUBBLE CHAMBERS**
photograph processing for, description of optical computer system for, 20: 43676

**BUBBLES**
effect on gas–solid contacting in fluidized beds, 20: 43483(R) (RPI-3639-1)
**BUILDING MATERIALS**
development for high-temperature oxidizing atmospheres, 20: 43842
use of plastics in, 20: 43471
**BULBS**
radiation effects on tulip, genetic and morphological γ, 20: 42861(T) (NSJ-tr-53)
**BUTADIENE, CHLORO-**
radioinduced polymerization of emulsions of, gamma, 20: 43374
**BUTADIENE, 2,3-DIMETHYL-**
radioinduced polymerization of, ESR studies of free radicals from electron, 20: 43325
**1,3-BUTADIENE, 2-METHYL-**
radioinduced polymerization of, ESR studies of free radicals from electron, 20: 43325
radioinduced polymerization of emulsions of, gamma, 20: 43374
**1,3-BUTADIENE, 2-METHYL- POLYMERS**
radiation on crosslinking of liquid and solid trans-, effects of physical state on, 20: 43326
**BUTANE, 1-CHLORO-**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**BUTANE, 2-CHLORO-**
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
**1-BUTANOL**
solvent properties for neptunium, 20: 43396
solvent properties for fructose, glucose, and sucrose, 20: 43402
**2-BUTANOL**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
**1-BUTENE**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**2-BUTENE, 2,3,-DIMETHYL-**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**1-BUTENE, 2-METHYL-**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
***tert*–BUTOXY**
reaction with aliphatic ketones, effects of deuterium on, 20: 43284
**BUTYL PHOSPHATES**
solvent properties for niobium and tantalum, 20: 43131
solvent properties for thorium, 20: 43450
dipentyl sulfoxides–TBP, solvent properties for thorium, 20: 43444
***sec*-BUTYLAMINE**
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
**BUTYRIC ACID, 2-AMINO-**
aminobutyric acid hydrochloride–cysteine hydrochloride, radiation effects on spin transfer in single crystals of, 20: 43317

## C

**CABBAGE**
radiation effects on seeds of, protons, 20: 42898
**CABLES**
power, use of superconductors of niobium, aluminum, and beryllium in, 20: 44562
radiation effects on, for SNAP 8, 20: 45194 (NAA-SR-11924)
**CADARACHE REACTORS (RAPSODIE)**
development and use as irradiation facility, 20: 45157
**CADMIUM**
deposition on thallium, effects of, on properties as beta source at 300 to 500°C, 20: 43400
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
properties as neutron poison, annotated bibliography on, 20: 45080
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
**CADMIUM FLUORIDES**
radioinduced effects on absorption, fluorescence, and bleaching of, x, 20: 45006
**CADMIUM IODIDES**
radiation damage in, electron microscopy of fission fragment, 20: 44023
**CADMIUM ISOTOPES Cd-107**
beta decay of, silver-107 energy levels from, (E), 20: 44782
gamma spectra, 20: 44634(R) (IDO-17188)
**CADMIUM ISOTOPES Cd-109**
determination in air-filter samples, radiochemical, 20: 43512(R) (ANL-7136, pp 315-27)
**CAFFEINE**
effects on *Escherichia coli*, genetic, 20: 42838(R) (ANL-7136, pp 140-54)
**CALCINATION**
effects on liquid wastes, 20: 45219
**CALCITES**
electron spin resonance spectrum of arsenite ions in gamma-irradiated, (E), 20: 45010
radioinduced thermoluminescence of, gamma and uv, 20: 43552
**CALCIUM**
activity coefficient of plutonium in liquid, estimated, 20: 43819
binding by lipoproteins in blood serum and cell membranes, 20: 42743 (UCRL-14631)
content in human bones, 20: 42781
content in Mediterranean Sea, effects of season, temperature, and Nile River flooding on, 20: 43508(R) (NP-16179)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in boron by x-ray fluorescence, 20: 43091 (UCRL-14879)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination in thorium dioxide, spectrographic, 20: 43105
determination of trace amounts of, in tungsten and molybdenum by atomic absorption spectrophotometry, 20: 43154
determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
effects of dietary, on strontium-85 retention in swine, 20: 42739(R) (COO-1339-3)
effects on radiosensitivity of plants, 20: 42915
long-term metabolism of, in human bones measured by radioisotope tracers and whole-body counters, 20: 42764
radioinduced release of, in oats and peaches and subsequent effects on texture, 20: 42815
ratio of, to strontium-90 in tissues of dogs on chronic ingestion regimen of the radionuclide, 20: 42780
reactions of gaseous, with rare earth chlorides, thermodynamics of, 20: 43222
separation from barium, cesium, and strontium by ion exchange using heated Dowex column, 20: 43436
separation from lithium chloride solutions by adsorption on alumina, 20: 43092 (Y-1553)
separation from scandium by ion exchange, 20: 43430
uptake and distribution in barley, oats, peas, and wheat, relation to strontium-90, 20: 42766
**CALCIUM CHLORIDES**
decontamination effects of, with ultrasonics on rat skin contaminated with $^{131}$I, $^{32}$P, or $^{90}$Sr, 20: 42811
metabolism of calcium-45-labeled, in teleost fish, 20: 42750
sorption by glass, tracer studies of kinetics of, 20: 43251
**CALCIUM COMPLEXES**
with DPTA and EDTA, effects on zinc-65 retention in rats, 20: 42789
**CALCIUM FLUORIDES**
uranium content, 20: 43564
$CaF_2$–LiF, density and molar volume of, 20: 43165 (BM-RI-6836)
**CALCIUM IONS**
effects of displacing, on enzyme activity and nucleotide metabolism in rat bone marrow, 20: 42788
reactions with stearate–stearic acid films, tracer studies of, 20: 43238
**CALCIUM ISOTOPES Ca-37**
mass from calcium-40 (He-3,He-6) reactions, (E), 20: 44659 (UCRL-16990)
**CALCIUM ISOTOPES Ca-40**
alpha reactions (α,d) at 24.8 Mev, angular distribution from, (E), 20: 43717
description using Hartree-Fock approximation with density-dependent two-nucleon interaction, (T), 20: 44785
deuteron reactions (d,t) and (d,He-3) with, cross sections for, (E), 20: 44794
deuteron reactions (d,p) at 11 Mev, proton polarization in, (E), 20: 44839
helium-3 reactions (He-3,He-6) with, calcium-37 mass from, (E), 20: 44659 (UCRL-16990)
proton reactions (p,n) with, scandium-40 mass from theoretical energy for, (E), 20: 44811
proton reactions (p,α), with potassium-37 energy levels from, (E), 20: 44838
**CALCIUM ISOTOPES Ca-42**
energy levels of description using shell model, (T), 20: 44762
**CALCIUM ISOTOPES Ca-43**
energy levels of description using shell model, (T), 20: 44762

**CALCIUM ISOTOPES Ca-44**
energy levels from the decay of isomeric scandium-44, (E), 20: 44682
energy levels of description using shell model, (T), 20: 44762
proton scattering by, isobaric analog states from, (E), 20: 44761
**CALCIUM ISOTOPES Ca-45**
content in seawater, 20: 43688
determination of, in body fluids by liquid scintillation counting, 20: 43117
energy levels of description using shell model, (T), 20: 44762
incorporation in stearate–stearic acid solutions, 20: 43238
metabolism of calcium chloride-incorporated, in teleost fish, 20: 42750
preparation of clean and carrier-free, 20: 43430
preparation of high-specific-activity, 20: 43398
radiation effects on release from plant tissues, gamma, 20: 42916
uptake by teleost fish, 20: 42750
**CALCIUM ISOTOPES Ca-46**
energy levels of description using shell model, (T), 20: 44762
**CALCIUM ISOTOPES Ca-47**
energy levels of description using shell model, (T), 20: 44762
kinetic studies of, metabolism in goats, 20: 42739(R) (COO-1339-3)
radiation effects on metabolism of, following pituitary irradiation, alpha, 20: 42744(R) (UCRL-16246, pp 19-35)
tracer use of, for measuring long-term calcium metabolism in human bones, 20: 42764
**CALCIUM ISOTOPES Ca-48**
energy levels of description using shell model, (T), 20: 44762
radioactivity of, search for, 20: 43550(R) (NYO-844-67)
**CALCIUM ISOTOPES Ca-49**
energy levels of description using shell model, (T), 20: 44762
**CALCIUM ISOTOPES Ca-50**
energy levels of description using shell model, (T), 20: 44762
**CALCIUM NITRATES**
effects on calcination of phosphomolybdate solutions, 20: 43186(T) (ORNL-tr-1344)
**CALCIUM OXIDES**
dissolution in fuel sample with uranium and zirconium oxides, 20: 43069(R) (IDO-14679, pp 51-9)
effects on ion-exchange properties of aluminum silicates, 20: 43449
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
sintering of, effects of water vapor on initial, 20: 43813(R) (COO-1122-3)
$CaO-UO_2-Y_2O_3-ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
**CALCIUM PHOSPHATES**
effects of radioactive, on cracking of cumene, 20: 43391
precipitation of, tracer studies of formation of Liesegang rings during, 20: 43249
use in separating strontium-90 from milk, 20: 43537
**CALCIUM SULFATES**
strontium distribution in, tracer studies of effect of morphological form on, 20: 43534
**CALCIUM TITANATES**
emissivity as coating in tests on stainless steel, 20: 43816(R) (PWA-2877)
performance as coating in beryllium emissivity tests, 20: 43816(R) (PWA-2877)
**CALDER HALL REACTORS**
design and performance of magnox, 20: 45171
**CALIBRATION**
of equipment for measuring thyroid radioiodine uptake, 20: 43031
**CALIFORNIA**
water plan program in, use of nuclear energy in, 20: 43195
**CALIFORNIUM ISOTOPES Cf-252**
fission neutron yield of, calibration using Harwell plutonium-240 standard, 20: 44594
**CALORIMETERS**
design and performance of low-temperature, for $\gamma$ and neutron dosimetry, 20: 43668(R) (ANL-7136, pp 1-16)
design of steady-state differential, for reactor environment, 20: 43663
use of rotating-bomb, for determination of heat of formation of beryllium fluoride, 20: 43269
**CAMERAS**
design of television, for use in radiation fields, 20: 43472
**CANADA**
gamma irradiation program, 20: 43759 (AECL-2298(Vol.4))
nuclear industry in, general survey, 20: 45102 (66-CNA-320)
nuclear power development in, industrial effects on, 20: 45245
radioisotope uses in, industrial, 20: 43763
**CAPTURE-TO-FISSION RATIOS**
measurement in low-power reactors, 20: 45071 (CONF-660303, pp 1092-7)
**CARBAMIC ACID, DIETHYLDITHIO–**
radioprotective effects on mice and rats, reaction mechanisms for, 20: 42998(R) (EUR-2992.f)
**CARBAMIC ACID, ETHYL ESTER**
effects combined with x radiation on tumor-resistant mice, 20: 42873
use in association with x radiation to induce pulmonary adenomas, 20: 42891
**CARBAZOLE**
analysis of, for sulfur and other elements, by neutron activation methods, 20: 43116
**CARBOHYDRATES**
radiation effects on metabolism in carrots, $\gamma$, 20: 42851(R) (NYO-3274-9)
utilization by plants of, effects of light on, 20: 42706(R) (NYO-2373-1)
**CARBON**
coatings of, compatibility with alumina at high temperatures, 20: 43927
deposition on steel, mechanism of, 20: 45114(R) (NP-16272)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in iron alloys, gravimetric, 20: 43071 (IDO-14679, pp 75-191)
determination in liquid sodium, 20: 43135
determination in stainless steel, titrimetric, 20: 43067(R) (IDO-14679, pp 6-46)
determination in steel by x-ray spectrochemical methods, 20: 43161
determination of, in gases by deuteron irradiation and neutron time-of-flight spectroscopy, 20: 43115
diffusion in niobium carbides at 1700 to 2300°C, 20: 43954
effects on coatability of niobium, 20: 43827 (GTR-19)
effects on corrosion of niobium and tantalum alloys in molten plutonium alloys, 20: 43829(R) (LA-3582)
effects on mechanical properties of neutron-irradiated iron, 20: 44001
effects on properties of sintered cobalt–tungsten carbide systems, 20: 43878
effects on radioinduced damage in iron and steel, 20: 44006
electron reactions (e,ep) at 0.2 and 0.5 Bev, differential cross sections for, (T), 20: 44740
meson ($\pi^-$) capture by, helium-8 production by, (E), 20: 44770
microstructure and properties of pyrolytic, deposited at 1900 to 2400°C, (E), 20: 43930
nucleons reactions with, cascade showers from, (T), 20: 44152
proton reactions at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
radiation effects on crystallinity and thermal conductivity of pyrolytic, neutron, 20: 44009
radioinduced dimensional changes in crystals of, fast neutron, 20: 44020
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
separation from thorium by electrotransport, 20: 43820
**CARBON DIOXIDES**
decomposition of, chemonuclear processes for, 20: 43300
determination in reactor blanket gas, design of continuously operating gas chromatogram for, 20: 43157
ionization energy in, measurement of effective, 20: 43193
production and methods of collection of, in combustion of samples for scintillation counting, 20: 43139
radioinduced in baked glass bulbs, gamma, 20: 44011
radioinduced production in meats, 20: 42973
radioinduced reactions with hydrocarbons, gamma and x, 20: 43333
yields from irradiation of polyethylene terephthalate, 20: 43378
yields from irradiation of polyethylene terephthalate, 20: 43378
**CARBON IONS**
ionization cross sections, electron impact, (T), 20: 44871(T) (CONF-660332-1)
**CARBON ISOTOPES**
use in geological dating, method for, 20: 43506(R) (COO-689-60, App.A-6)
**CARBON ISOTOPES C-12**
alpha scattering by, differential cross sections for, (E), 20: 43741
binding energy and single-particle orbitals of, calculations using Hartree-Fock approximation, (T), 20: 44779
description using Hartree-Fock approximation with density-dependent two-nucleon interaction, (T), 20: 44785
deuteron reactions at 12.4 Mev, angular distribution of products from, (E), 20: 43717
deuteron reactions (d,pn) at 5.39 Mev, (E), 20: 44731
deuteron reactions (d,t) and (d,He-3) with, cross sections for, (E), 20: 44794
deuteron reactions (d,$\alpha$) with, differential cross sections for, (T), 20: 44826
helium-3 elastic scattering at 8.5 to 10.0 Mev, (E/T), 20: 44728
helium-3 reactions (He-3,$\alpha$) at 8.5 to 10.0 Mev, (E/T), 20: 44728
meson ($\pi$) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
mesons ($K^-$) capture by, $Y_0^*(1405)$ production in, (E), 20: 44657 (UCRL-16602)
neutron reactions $(n,n')3\alpha$ at 15.5 Mev, (E), 20: 44849
neutron scattering at low energy, channel coupling in, (T), 20: 44653 (PUC-937-219)
proton reactions (p,n) with, nitrogen-12 mass from threshold energy for,

(E), 20: 44812
separation from carbon-14, by equilibrium evaporation of methane, 20: 43093(T) (BNL-tr-84)
**CARBON ISOTOPES C-13**
determination in gases, by proton irradiation and neutron time-of-flight spectroscopy, 20: 43115
deuteron reactions (d,n) at 3.9, 5.5, and 7.0 Mev, nitrogen-14 energy levels from, (E), 20: 44601(R) (ANL-7218)
energy levels from beryllium-9 ($\alpha$,n) reactions at 4.3 to 12.0 Mev, (E), 20: 44723
energy levels of, 5.51- and 6.10-Mev, (E), 20: 44775
helium-3 reactions (He-3,d) at 13 and 17 Mev, nitrogen-14 energy levels from, (E), 20: 44601(R) (ANL-7218)
hyperfine splittings of, in hexakis(trifluoromethyl)benzene, effects of temperature on, 20: 43225
**CARBON ISOTOPES C-14**
beta spectra of, resolution of, from tritium beta spectra by liquid scintillation counting, 20: 43098
determination in biological materials by liquid scintillation counting, combustion methods for, 20: 43128
determination in biological materials by scintillation counting, combustion method for use in, 20: 43139
determination in organic acids from plant material and silage by liquid scintillation counting, 20: 43125
determination in urine by separation as carbon dioxide and scintillation counting, 20: 43136
determination of, by beta counting, ionization chamber for, 20: 43106
incorporation in aspartic acid semialdehyde, 20: 43273
incorporation in 3-methyl-2-butenyl pyrophosphate, 20: 43407
role in soil organic matter research, 20: 42795
separation from carbon-12, by equilibrium evaporation of methane, 20: 43093(T) (BNL-tr-84)
tracer use in DNA metabolism studies, 20: 42777
use in age estimations for Pleistocene events, 20: 43557
use in age estimation, review of, 20: 43560
use of L-alanine-incorporated, for intestinal absorption studies in $\gamma$-irradiated rabbits, 20: 42972
**CARBON MONOXIDES**
radioinduced in baked glass bulbs, gamma, 20: 44011
yields from gamma radiolysis of furan and tetrahydrofuran, 20: 43295
yields from irradiation of polyethylene terephthalate, 20: 43378
**CARBON STEEL**
analysis of coupons of, for fission products, 20: 43072(R) (IDO-14679, pp 193-229)
radioinduced damage in, effects of annealing on neutron, 20: 44006
**CARBON SULFIDES**
effects on gamma-induced polymerization of styrene at −78°C, 20: 43308
spectra of, intensity measurements of absorption bands in, 20: 43178 (NRL-6394)
spectra of, isotope shifts in ultraviolet bands of, 20: 43209
**CARBON SYSTEMS**
C–HfC, electric conductivity up to 1600°C, 20: 43917 (USBM-RC-1113)
C–Mo–Ti–Zr, fabrication and properties of TZC, 20: 43830(R) (NASA-CR-72029)
C–Nd–O, preparation and properties of $Nd_2O_2C_2$ in, 20: 43214
C–WC, machining procedures for, 20: 43864 (Y-1550)
**CARBON TETRACHLORIDE**
analysis for iodine in solutions of, colorimetric, 20: 43071 (IDO-14679, pp 75-191)
properties for chlorination of uranium (IV) oxide, 20: 43443
use in preparation of single crystals of tungsten oxide by chemical transport, 20: 43257
**CARBON TETRAFLUORIDE**
effects on hydrogen yields in gamma radiolysis of cyclohexane and hexane, 20: 43316
**CARBOXYLATION**
radioinduced, of hydrocarbons, gamma and x, 20: 43333
**CARCINOGENESIS**
genetic control of, in tobacco plants, 20: 42704 (BNL-967)
radiation effects on mouse skin, induced by dimethylbenzanthracene, beta or x, 20: 42969
radioinduced in hamster cells, x, 20: 42927
radioinduced in mice, mechanisms for $\beta$, 20: 42840(R) (ANL-7136, pp 164-90)
radioinduced in rat mammary epithelium, relation of DNA synthesis to x, 20: 42840(R) (ANL-7136, pp 164-90)
radioinduced, following radiotherapy of juvenile laryngeal papillomatosis in man, 20: 43023
**CARCINOGENS**
effects of dimethylbenzanthracene in combination with beta or x radiation on mouse skin, 20: 42969
effects of 2,7-diacetylaminofluorene on rats, co-carcinogenic with fission neutrons, 20: 42840(R) (ANL-7136, pp 164-90)
**CARCINOMAS**
development of laryngeal, following radiotherapy of juvenile papillomatosis, 20: 43023
evaluation of radiotherapy for testicular, 20: 43038
protein metabolism in tissues of mice with Ehrlich's ascites *in vitro* studies, 20: 42728
radioinduced in mice, mechanisms of, 20: 42873
radioinduced metastasis of, model for, 20: 42963
radiotherapy and surgery of dysembryoma of testis, 20: 43034
radiotherapy of lung, functional impairment and pulmonary sclerosis following $\gamma$, 20: 43030
radiotherapy of pelvic, 20: 42796
radiotherapy of skin metastases resulting from mammary, 20: 43039
radiotherapy of, effects on excretion of $\beta$-glucuronidase, 20: 43025
radiotherapy of, iron content in patients receiving, 20: 42908
radiotherapy using 35-Mev electrons, comparison of clinical and tissue culture studies, 20: 43018
**CARDIOGRAPHY**
radiation effects on electrocardiograms, head-exposure, 20: 42925
**CAROLINAS-VIRGINIA TUBE REACTOR**
performance of, reliability of, 20: 45181
**CARTILAGE**
Thorotrast sorption by articular, in rabbits, 20: 42772
transformation to bone of, biochemical study of, 20: 42997(R) (ANL-7136, pp 191-204)
**CASCADE SHOWERS**
calculation of electron-photon, computer program for, 20: 44153
calculation of nucleon-electron, computer program for, 20: 44152
**CASEIN**
effects of dietary levels of, on liver changes in gamma-irradiated rats, 20: 42864
**CAST IRON**
analysis for cerium, photometric, 20: 43143
**CASTING**
liquid-level control in continuous steel, radiometric, 20: 43761
**CATALASES**
activity in blood and tissues of mouse mutants, 20: 42837(R) (ANL-7136, pp 124-40)
effects on alcohol metabolism in mice, 20: 42837(R) (ANL-7136, pp 124-40)
**CATHODES**
performance of heated glass, in electrostatic beam separator, (E), 20: 44046
**CATIONS**
binding by lipoproteins in blood serum and cell membranes, 20: 42743 (UCRL-14631)
chemistry of transition metal oxygen-containing, review on, 20: 43190
effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775
**CATS**
radiation injuries to oral tissues in, following subcutaneous injection of radionuclides, 20: 42967
**CATTLE**
cesium-137 retention in, 20: 42739(R) (COO-1339-3)
iodine-131 and -133 uptake by dairy, from hay, 20: 43576 (CONF-660621-7)
radiation effects on *Moraxella bovis* infections in, uv, 20: 42863
radiation effects on morphology and motility of sperm of, exposed in suspensions, 20: 42950
**CAVES**
monitoring of, television equipment for, 20: 43472
radioactivity in, filtering systems for airborne, 20: 43466 (DP-MS-66-16)
**CAVITY RESONATORS**
design for observation of EPR spectra in crystals at 4.2°K, 20: 43721
plasma eigenfrequencies in, exact solution for, (T), 20: 44907
**CELLOPHANE**
diffusion of sodium through, coefficients of, 20: 43239
**CELLULOSE**
iodine retention on, in air–steam and helium atmospheres, 20: 43067(R) (IDO-14679, pp 6-46)
radiation and chemical methods for grafting synthetic polymers on, review of, 20: 43346
radiation chemistry of, 20: 43294
radioinduced graft polymerization of, 20: 43294
thermal stability of membraneous filters of, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)
asbestos–cellulose, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)
asbestos–cellulose, thermal stability of filters of, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)
cellulose–charcoal, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)
**CELLULOSE ACETATES**
iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)

thermal stability of membraneous filters of, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)

**CENTRAL AMERICA**

agricultural applications of gamma radiation in tropical environments in, 20: 42850(R) (NYO-2043-130)

**CENTRIFUGATION**

effects of, on injuries in mice induced by subsequent exposure to $\gamma$ rays or proton beams, 20: 42985
effects on development and growth of plants, 20: 42703(R) (ANL-7136, pp 302-14)
rotor speed and temperature by radiotelemetry, 20: 43637(R) (UCRL-16246, pp 168-75)

**CERAMIC MATERIALS**

electric properties in high vacuum, 20: 44043 (RHEL-R-124)
strength of sintered, effects of hydrostatic support pressure on ultimate compressive, 20: 43909 (SC-DC-66-1888)
use of spheres of, for studies of gastrointestinal transit of manganese-54 or uranium carbide particles, 20: 42740 (LA-DC-7764)

**CERIUM**

activity coefficient of plutonium in liquid, estimated, 20: 43819
content in Gulf of Mexico surface water, 20: 43087(R) (TID-23295, Sect.4)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in magnesium alloys, quantometric, 20: 43112
effects of subcutaneously injected, on oral tissues of experimental animals, 20: 42967
magnetic properties at 2 to 300°K, 20: 43939
phase transformation temperatures of, effects of rare-earth additions on, 20: 45011
separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)
separation of, from other fission products by column partition chromatography, 20: 43419 (LA-DC-7869)

**CERIUM ALLOYS**

Al–Ce, properties of intermetallic compounds in, tabulation of, 20: 43972
Ce–Co, crystal structure of intermetallic compound, 20: 43920
Ce–Co–Pu, corrosive effects of liquid on carburized and uncarburized niobium and tantalum alloys, 20: 43829(R) (LA-3582)
Ce–Co–Pu, density and viscosity of liquid, 20: 43889 (CONF-660606-39)
Ce–Co–Pu, development and testing as liquid fuel, 20: 43814 (LA-DC-7581)

**CERIUM CHLORIDES**

properties of, magnetic and thermal, 20: 43176 (NP-16302)
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

**CERIUM COMPLEXES**

with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with glycolic and lactic acids, thermodynamic properties of, 20: 43215

**CERIUM FLUORIDES**

$CeF_3$–KF, density and molar volume of, 43165 (BM-RI-6836)
$CeF_3$–LiF, density and molar volume of, 43165 (BM-RI-6836)
$CeF_3$–NaF, density and molar volume of, 43165 (BM-RI-6836)

**CERIUM IODATES**

sorptive properties for actinides and lanthanides, 20: 43448

**CERIUM IONS**

analysis of tetravalent and trivalent mixture of, reagents for qualitative, 20: 43122
effects on cobalt determination in steel, 20: 43145
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
fluorescence of trivalent, in sodium tungstate solution, 20: 43211
fluorescence of trivalent, in potassium oxalate solution, 20: 43212
hydrolysis of tetravalent, in perchloric acid solutions, effects of concentration on, 20: 43189

**CERIUM ISOTOPES**

fixation by muds, 20: 43544

**CERIUM ISOTOPES Ce-138**

energy levels from decay of isomeric praseodymium-138, (E), 20: 44643 (JINR-P-2819)

**CERIUM ISOTOPES Ce-140**

energy levels from lanthanum-140 decay, (E), 20: 43684
meson $(\pi)$ and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**CERIUM ISOTOPES Ce-141**

content in nuclear debris over Sweden, 1962 to 1963, 20: 43524
separation from irradiated thorium oxides using molten sodium chloride, 20: 43454

**CERIUM ISOTOPES Ce-142**

yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**CERIUM ISOTOPES Ce-143**

determination in presence of neptunium-239, 20: 43067(R) (IDO-14679, pp 6-46)
determination in presence of neptunium-239, extraction-radiometric, 20: 43072(R) (IDO-14679, pp 193-229)

**CERIUM ISOTOPES Ce-144**

content in Black Sea, 1960–1964, 20: 45227
determination in rainwater in New Zealand from 1956 to 1959, 20: 43530
release to atmosphere from NRTS, 20: 45219
separation from irradiated thorium oxides using molten sodium chloride, 20: 43454
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**CERIUM ISOTOPES Ce-145**

beta decay, 20: 43419 (LA-DC-7869)

**CERIUM ISOTOPES Ce-146**

beta decay, 20: 43419 (LA-DC-7869)

**CERIUM ISOTOPES Ce-147**

half life, 20: 43419 (LA-DC-7869)

**CERIUM NITRIDES**

magnetic properties at 2 to 300°K, 20: 43939

**CERIUM OXIDES**

preparation of single crystals of, from lithium ditungstate solvent, (E), 20: 43818
$CeO_2$–$UO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)

**CERIUM PERRHENATES**

preparation and properties of, 20: 43217

**CERIUM PHOSPHATES**

crystal structure of, infrared spectral studies on, 20: 43219

**CERIUM SULFATES**

performance in gamma dosimeters, 20: 43668(R) (ANL-7136, pp 1-16)
use in determination of iron and vanadium, 20: 43144

**CERIUM TUNGSTATES**

preparation and physicochemical properties of $(CeW_8O_{28})^{4-}$, 20: 43253

**CERMETS**

crystal structure of nickel–thoria–uranium, 20: 43902 (NMI-7018)
fabrication of aluminum–uranium oxides for fuel plates, 20: 43844 (AAEC-TM-315)
production and structure of extruded stainless steel–urania, 20: 43848(R) (BNWL-269, pp 5.1-36)

**CESIUM**

cyclotron echoes from highly ionized plasma of, (E), 20: 44936
determination in seawater by activation and gamma spectrometry, 20: 43059 (BNWL-SA-674)
determination in silicate rocks by neutron activation methods, 20: 43133
distribution in human blood, 20: 42778
electron density maximization in Penning gas mixture with, ionized by fission fragments, 20: 44933
ion-acoustic waves in plasma of, excitation of, (E/T), 20: 44960
ionization properties of, effects of high pressures and temperatures on, 20: 44979
metabolism in mammals, interspecies comparisons, 20: 42768
plasma of, low-frequency oscillations in thermal, (E), 20: 44906
separation from barium, calcium, and strontium by ion exchange using heated Dowex column, 20: 43436
separation from rubidium by ion exchange, 20: 43133
separation from strontium by sorption by vermiculite, effects of pH and biotite impurities on, 20: 43130
separation of americium, curium, europium, and promethium from, by paper electrophoresis, 20: 43451
sorption by illite, montmorillonite, and vermiculite clays, 20: 43455
specific volume at 1577 to 2340°F, (E), 20: 43946
thermodynamic properties of, 20: 43809 (BNL-50003)
thermodynamic properties at boiling point to 2550°F, (E), 20: 43944
use in thermionic converters, 20: 44168
vapor pressures at 2350°F, saturation, (E), 20: 43945

**CESIUM BROMIDES**

radioinduced color centers in, optical and thermal properties of, 20: 45036

**CESIUM IODIDES**

electron ionization loss at 20 to 150 Mev in, 20: 44232
proton channeling in, 20: 45016
scintillation of thallium-activated crystals of, temperature effect on decay time of gamma, 20: 43695

**CESIUM IONS**

reactions of monovalent, with dinonylnaphthalenesulfonic acid, effects of diluent on, 20: 43447

**CESIUM ISOTOPES**

fixation by muds, 20: 43544

**CESIUM ISOTOPES Cs-131**

production of carrier-free, 20: 43398

**CESIUM ISOTOPES Cs-133**

separation from neutron-deficient lanthanum isotopes, 20: 43067(R)

(IDO-14679, pp 6-46)
**CESIUM ISOTOPES Cs-134**
determination in neutron-irradiated clays and soils, 20: 43607
gamma spectra, 20: 44634(R) (IDO-17188)
**CESIUM ISOTOPES Cs-137**
content and distribution in Atlantic Ocean and adjoining seas, 1963-64, 20: 43540
content in air, soil, hay, milk, plankton, sediment, aqueous plants and fish, Switzerland, 1963, 20: 43519
content in Black Sea, 1960–1964, 20: 45227
content in Clinch River from ORNL waste solutions, 20: 45223
content in diet, environment, food, and milk in Chicago, Ill., area, 1965, 20: 43512(R) (ANL-7136, pp 315-27)
content in grass relation to precipitation and harvest yields, 20: 43527
content in human bones, in Moscow, 1961 to 1964, 20: 42741 (NP-16265)
content in human bones and tissues, 20: 43626
content in milk and wheat flour in New Zealand, 1965, 20: 43581(R) (NP-16245)
content in milk in Japan, November 1962 to September 1963, 20: 43520
content in people and reindeer in Sweden, 20: 42736
content in river water in Germany, 1961 to 1966, 20: 45225
determination in eggs and meat from poultry, spectrometric, 20: 42735
determination in irradiated thorium by ion exchange, 20: 43069(R) (IDO-14679, pp 51-9)
determination in rainwater in New Zealand from 1956 to 1959, 20: 43530
determination in seawater by activation and gamma spectrometry, 20: 43059 (BNWL-SA-674)
determination in water and milk in Bombay, low-level beta counting method for, 20: 43532
distribution in freshwater ecosystem, 20: 43512(R) (ANL-7136, pp 315-27)
distribution in human blood, 20: 42778
distribution in water and silt of British estuaries, 20: 45224
effects on erythropoietic index and iron content in man, 20: 42908
excretion from man, biological half life for, 20: 42794
excretion in rats, effects of ferric cyanoferrate on fecal, 20: 42786
gamma activity of, spectrometric method for measuring, 20: 43069(R) (IDO-14679, pp 51-9)
gamma spectra, 20: 44634(R) (IDO-17188)
ingestion, excretion, and accumulation in man, relation between, 20: 42794
intake in food, methods for estimating, 20: 43573 (CONF-765-13)
radiation doses to Alaskan Eskimos from, 20: 43622
release to atmosphere from NRTS, 20: 45219
retention of, in cattle and sheep, 20: 42739(R) (COO-1339-3)
separation from Clinch River sediments, 20: 45216 (ORNL-3721)
sorption from waste solutions by Yazoo and Zilpha clays, 20: 45221
sorption of by *Mytilus galloprovicialis*, 20: 42770
use for radiotherapy of cancers, techniques and dosimetry for, 20: 43021
use in calibration of thyroid radioiodine uptake measurements, 20: 43031
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**CESIUM ISOTOPES Cs-144**
content in river water in Germany, 1961 to 1966, 20: 45225
distribution in water and silt of British estuaries, 20: 45224
**CESIUM SYSTEMS**
Cs–graphite, stability, structure, and thermodynamic properties of phases in, at 400 to 800°C, (E), 20: 43948
**CESIUM TUNGSTOCERATES**
preparation and physicochemical properties, 20: 43253
**CHALK RIVER PLANT**
research programs at, 20: 45234 (AECL-2460)
**CHARCOAL**
sorptive properties of activated, for methyl iodide in air–steam systems, 20: 45049 (ORNL-P-2431)
use in iodine filter system, 20: 43584 (ORNL-P-2411)
cellulose–charcoal, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)
charcoal–glass, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)
**CHARGED PARTICLE BEAMS**
focusing and steering of, quadrupole and box magnets for, 20: 44065
interactions with plasma, wave amplification, (T), 20: 44965
separation of, use of heated glass cathodes in, (E), 20: 44046
**CHARGED PARTICLES**
covariant wave equation in electromagnetic field for spin-one, 20: 44480 (IS-T-95)
emission in thermal-neutron reactions with nuclei, review on, 20: 44666(T) (INDSWG-101, pp 1-22)
identification of, design of pulse multiplier for, 20: 43670 (INR-693/I/PL)
identification of, semiconductor system for, 20: 43717
interactions in crystal lattices, directional effects during, (T), 20: 44991 (BNL-10544)
interactions of, kinematic laws and invariance for, 20: 44033
motion in Coulomb field, bremsstrahlung emission from, (T), 20: 44039
motion in electromagnetic fields, (T), 20: 44985(T)
motion in magnetic fields, cyclotron radiation from, (T), 20: 44913
motion in plasma, wave properties of, (T), 20: 44958
motion in spatially periodic magnetic fields, 20: 44973
motion in spatially modulated magnetic fields, resonance in, 20: 44974
motion in vicinity of geomagnetic neutral point, 20: 44460
scattering in inhomogeneous medium, multiple, 20: 44212
scattering in spark chambers, Molière theory for multiple, 20: 43744
spectra from nuclear reactions, computer program for automatic decomposition of, 20: 44656 (TID-23315)
temperature in afterglow of C-stellarator discharges, (E), 20: 44911
trapping in geomagnetic shells, model for, 20: 44416 (AD-639436)
trapping in magnetic mirror machines, lifetime of, 20: 44855 (IAE-1078)
use in detection of magnetic field inhomogeneities, (T), 20: 44038
**CHEMICAL ANALYSIS**
manpower requirements for, 20: 43069(R) (IDO-14679, pp 51-9)
pipette for, design of remotely operated, 20: 43077 (NP-16214)
program for, of fissionable materials for AEC purchase, 20: 43070(R) (IDO-14679, pp 60-9)
reactions of dioximes of maleimide and 1,2,3,6-tetrahydrophthalimide in, 20: 43095
**CHEMICAL ISOMERISM**
radioinduced, in polyamino acids by gamma radiation, 20: 42826
radioinduced, in stilbene by triplet states produced in irradiated benzene, 20: 43360
**CHEMICAL RADIATION DETECTORS**
book: *Chemical Dosimetry of Ionizing Radiations*, 20: 43293(T) (AD-633448)
performance of ceric sulfate and ferrous sulfate, for dosimetry, 20: 43668(R) (ANL-7136, pp 1-16)
use of ferro-ferrisulfate, for $\gamma$-dosimetry in radiobiology, 20: 43696
**CHEMICAL WARFARE**
hazards of, to U.S. populations, 20: 43566 (AD-625251)
**CHEMICALS AND REAGENTS**
analysis for trace amounts of copper by isotope dilution and activation methods, 20: 43137
production of, development and economics of chemonuclear processes for, 20: 43300
**CHEMISTRY**
book: *Nuclear Chemistry*, 20: 43056(T) (JPRS-36943)
research programs at Chalk River on, 20: 45234 (AECL-2460)
research programs on, in France, 20: 45239(R) (NP-16267)
research reactor uses in, 20: 45206 (ORO-3191-1)
**CHEMOTHERAPY**
pathological characteristics of leukemic reticulosarcomatosis induced by, 20: 42729
use for control of bacterial infections during radiation sickness, 20: 43052
**CHERENKOV RADIATION**
emission by electrons moving in channels in cylindrical dielectric rods, 20: 44273
theory for magnetic, vacuum polarization corrections for, 20: 44061
**CHICAGO**
fallout monitoring, 1965, 20: 43512(R) (ANL-7136, pp 315-27)
**CHICKENS**
cesium-137 content in eggs and meat from, 20: 42735
lens differentiation in early embryos of, 20: 42839(R) (ANL-7136, pp 154-61)
radiation effects on, $\gamma$ and x, 20: 42833(R) (ANL-7136, pp 16-46)
radiation effects on thymic lymphoid tissue in chicks, restoration after local and whole-body x, 20: 42935
radiation effects on development of *Ascaridia galli* parasites of, x, 20: 42968
**CHIMERAS**
immunological tolerance to radiation, effects of antigen excess on mouse, 20: 42730
mouse radiation, metabolism of oxygen and nitrogen in, 20: 42854(R) (TID-23127)
radiation guinea pig, immune reactions to toxins of, 20: 42878
radiation mouse, immunological tolerance to, 20: 42730
**CHINA**
nuclear explosion in, fallout particles in Japan from, 20: 43528
**CHINON REACTORS (EDF-3)**
containment for, design and construction of prestressed concrete, 20: 45127(T) (ORNL-tr-1228)
**CHLORAMIDES**
p-toluenesulfon-, use in radioiodination of tissue-soluble proteins in rabbits and rats, 20: 43274
**CHLORAMPHENICOL**
photoreversal of uv-induced mutations in *E. coli* for sensitivity of, 20: 42812

**CHLORIDE IONS**
effects on isotopic exchange between iodide and iodate ions, 20: 43248
**CHLORINE**
content in chondritic meteorites, 20: 44077
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in boron by x-ray fluorescence, 20: 43091 (UCRL-14879)
determination in polymers prepared in methylene chloride, activation method for, 20: 43339
determination in water, radiochemical method for, 20: 43063 (EUR-2990.f)
effects on rare earth spectra in flames, 20: 43152
neutron elastic and inelastic scattering at 14.2 Mev, (E), 20: 44746
properties for chlorination of uranium (IV) oxide, 20: 43443
use in preparation of single crystals of tungsten oxide by chemical transport, 20: 43257
**CHLORINE IONS**
detection of negative, design of scintillation detector for, 20: 43735
effects on gain of electron multiplier tubes, (E), 20: 43659
**CHLORINE ISOTOPES Cl-32**
mass from threshold energy for sulfur-32 (p,n) reactions, (E), 20: 44811
**CHLORINE ISOTOPES Cl-34**
energy-level quantum numbers and transitions from beta decay of argon-34, (E), 20: 44759
gamma spectra, 20: 44634(R) (IDO-17188)
**CHLORINE ISOTOPES Cl-35**
effects on centrifugal stretching constants in hydrochloric acid, 20: 44123
energy-level quantum numbers and transitions, (E), 20: 44808
neutron elastic and inelastic scattering at 14.2 Mev, (E), 20: 44746
**CHLORINE ISOTOPES Cl-36**
preparation of high-specific-activity, 20: 43398
use in age estimations for Pleistocene events, 20: 43557
**CHLORINE ISOTOPES Cl-37**
neutron elastic and inelastic scattering at 14.2 Mev, (E), 20: 44746
proton reactions (p,n) with, yield curves for, (E), 20: 44612 (CONF-660303, pp 562-76)
**CHLOROFORM**
effects on selectivity coefficients of monovalent cations for dinonylnaphthalenesulfonates, 20: 43447
**CHLOROGRAPHIN**
labeling with iodine-131, 20: 43397
**CHOLESTEROL**
radioinduced formation of alkanes and isoalkanes from, in meats, 20: 42973
**CHOLINE, ACETYL-**
radiation effects on metabolism of, in nerve tissues of rabbits, γ, 20: 42875
radiation effects on content in insect eggs and pupae, γ, 20: 42874
radiation effects on reactivity of rat intestine to, 20: 42964
**CHROMATOGRAPHY**
equipment and method for analyzing hydrocarbon photolysis products, 20: 43288(R) (CALT-532-1)
equipment for gas, for analysis of reactor blanket gas, 20: 43157
exchange labeling in chromatographic systems, 20: 42738(R) (ANL-7136, pp 255-65)
gas, design of argon-ionization helium-electron capture detector for use in, 20: 43156
isotope effects of carbon-14 and tritium on, in fractionation of methyl esters of linoleic, oleic, and stearic acids, 20: 43394
isotopic exchange and column efficiency in gas, calculations for, 20: 43103
pulse analyzer for gas, design and performance of, 20: 43643
**CHROME AZUROL S**
analytical use in spectrophotometric determination of yttrium, 20: 43110
**CHROMIUM**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in powder samples by spectrographic methods, semiquantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination in weak oxidizing solutions, volumetric, 20: 43071 (IDO-14679, pp 75-191)
determination of trace amounts of, in tungsten and molybdenum by atomic absorption spectrophotometry, 20: 43154
determination of, in carbazole by neutron activation methods, 20: 43116
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
effects on photometric determination of cerium in cast iron and steels, 20: 43143
reactions with europium in aqueous perchloric acid solutions, spectrophotometric studies on kinetics of, 20: 43228
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
thermal expansion of, linear, 20: 45106(R) (ANL-7249)
**CHROMIUM ACETATES**
use in preparation of high-specific-activity chromium-51, 20: 43401
**CHROMIUM ALLOYS**
corrosion in oxidizing atmospheres at high temperatures, 20: 43842
Al–Cr–Fe, corrosion in oxidizing atmospheres at high temperature, 20: 43842
Al–Cr–Fe–Mo–Ti, properties of, effects of high-temperature thermomechanical treatment on, 20: 43961
Cr–Mo, thermal expansion of, 20: 43964
Cr–Mo–Ti, phase conversions and properties of, 20: 43970
Cr–Re, atomic ordering in sigma phase, 20: 43890 (COO-1198-385)
Cr–Ti–V, phase conversions and properties of, 20: 43970
Cr–Ti–V, radiation effects on mechanical and physical properties of, 20: 45106(R) (ANL-7249)
Cr–Ti–V, thermal expansion of, linear, 20: 45106(R) (ANL-7249)
Cr–U, crystal structure of, model of zonal dislocations in, 20: 43955
Cr–V, corrosion in sodium at 650°C, 20: 43809 (BNL-50003)
Cr–V, thermal expansion of, 20: 43964
Cr–W, decomposition of solid solutions of, mechanism of, 20: 43914 (UCRL-16619)
**CHROMIUM IONS**
determination of trivalent chromium-51-labeled, in sodium chromate by thin-layer chromatography and scintillation counting, 20: 43114
effects on cobalt determination in steel, 20: 43145
effects on lithium niobates, doping, 20: 43242
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)
**CHROMIUM ISOTOPES**
separation of, chemical purification following electromagnetic, 20: 43801
**CHROMIUM ISOTOPES Cr-50**
neutron capture by, chromium-51 energy-level spins and transitions from, (E), 20: 44693
**CHROMIUM ISOTOPES Cr-51**
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
energy-level spins and transitions from neutron capture by chromium-50, (E), 20: 44693
preparation of pure high-specific-activity, by recoil enrichment using ammonium chromate, chromium acetylacetonate, and potassium chromate targets, 20: 43401
use as tracer to study sand movement in rivers, 20: 43549 (NP-16200)
**CHROMIUM ISOTOPES Cr-52**
energy levels from scattering, vibrational, (E/T), 20: 44795
meson (π) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
**CHROMIUM OXIDES**
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
properties as bearing coating, 20: 43481(R) (NYO-3237-6)
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
**CHROMIUM STEEL**
heat treatments at 900°C, austenizing effects on PM 24, 20: 43891 (EURAEC-1686)
Cr–Mo, corrosion by sodium in loops, statistical analysis of data on, 20: 43826 (GEAP-4830)
Cr–Mo, mechanical properties of, effects of air, helium, and sodium at 1100°F on, 20: 43897 (MSAR-66-174)
Cr–Mo–Ti, corrosion by sodium in loops, statistical analysis of data on, 20: 43826 (GEAP-4830)
**CHROMIUM SYSTEMS**
Cr–Ni–P, radiation effects on AWS BNi-7 braze, in-reactor, 20: 44027
Cr–Ni–$ThO_2$, oxidation and properties of composite effects of high temperatures on, 20: 43845(R) (AD-637573)
Cr–Si–Ti, deposition and performance as oxidation-resistant coating for niobium alloys, 20: 43827 (GTR-19)
**CHROMOSOMES**
aberrations in mouse, induced by acceleration and vibrations in combination with x rays, 20: 42986
characteristics of, in radioinduced giant cells in tissue cultures, 20: 42841(R) (ANL-7136, pp 266-89)
characterization and pairing of, computer, 20: 42837(R) (ANL-7136, pp 124-40)
effects of space flight on aberrations in, 20: 42909
effects of zygosity of Drosophila, on competitive ability and fitness of unirradiated and x-irradiated populations, 20: 42922
function and structure of, model for, 20: 45243 (UCRL-14625(Rev.1))
mechanism for induction and maintenance of, *in vivo*, 20: 42931
radiation effects on silkworm spermatocytes, uv, 20: 42895
radioinduced aberrations in Tradescantia, cytological studies of x, 20: 42706(R) (NYO-2373-1)
radioinduced aberrations in cultured kidney cell, effects of infrared on frequency of x, 20: 42837(R) (ANL-7136, pp 124-40)
radioinduced aberrations in human leukocyte, following thyroid therapy,

*β* and x, 20: 42857(R) (TID-23228)
radioinduced aberrations in mouse lymphoma, negative pion, 20: 42859(R) (UCRL-16246, pp 100-2)
radioinduced aberrations in barley grown at low and high altitudes, *γ*, 20: 42894
radioinduced aberrations, gamma and proton, 20: 42898
radioinduced aberrations in *Vicia faba*, frequency of, 20: 42920
radioinduced aberrations in *Vicia faba* during meiosis, x, 20: 42921
radioinduced aberrations in barley, genotype sensitivity in x, 20: 42923
radioinduced aberrations in human, following cancer therapy, 20: 42931
radioinduced aberrations in *Crepis capillaris*, x, 20: 42936
radioinduced aberrations in continuously irradiated rat bone marrow, dose effect studies, 20: 42951
radioinduced breaks in *Vicia faba*, effects of 2,4-dinitrophenol on rejoining, 20: 42913
radioinduced X-autosomal translocations in Drosophila, 20: 42709(R) (TID-23233)
repair of x-radioinduced aberrations in, of Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
review of radioinduced aberrations in, 20: 42931

**CHYMOTRYPSIN**
radiation effects on heat and light-induced phosphorescence of, ultraviolet, 20: 42803
radiation effects on luminescence of frozen solutions of, in liquid nitrogen, ultraviolet, 20: 42804

**CIRCADIAN CLOCK**
molecular model for, 20: 42839(R) (ANL-7136, pp 154-61)

**CIRCUITS**
control and synchronizing, for liquid scintillation spectrometer, 20: 43749(P)
performance of tunnel-diode monostable, 20: 43649
testing of nanosecond pulse, dismountable pulse tube for, 20: 43644

**CITRIC ACID**
radiation effects on metabolism in carrots, *γ*, 20: 42851(R) (NYO-3274-9)

**CIVILIAN DEFENSE**
assessment of plague epidemiology for post-attack planning, 20: 43587 (RM-4968-TAB)
blast injuries in, direct air-, 20: 42710 (TID-23348)
fallout radiation patterns in residential structures, 20: 43496 (CEX-59.7B(Pt.1))
radiological countermeasures required for postattack period, 20: 43567 (AD-635820)
shielding properties of structures against fallout, calculation of, 20: 43568 (AD-636787)

**CLAYS**
gamma spectra of neutron-irradiated, changes of, 20: 43607
properties of Yazoo and Zilpha, in decontaminating waste solutions, 20: 45221
radioactivity induced in, neutron, 20: 43607

**CLEANING**
methods for beryllium alloys, 20: 43857 (NASA-TM-X-53453(Vol.4))
methods for, in nuclear and aerospace applications, 20: 43599

**CLEANING SOLUTIONS**
efficiency of, effects of ultrasonics on, 20: 43623

**CLINCH RIVER**
hydrology of, 20: 45216 (ORNL-3721)
waste disposal in, radioactivity from, 1962 to 1963, 20: 45216 (ORNL-3721)

**CLOSTRIDIUM**
radiation control of growth of *Cl. botulinum*, type E, on sea foods, 20: 43774
radiation control of growth of *Cl. botulinum*, type E, on sea foods, 20: 43775
radiation effects on toxin formation by *Cl. botulinum*, type E, on fish, effects of polythene packaging and vacuum exposure on *γ*, 20: 43779

**CLOUD CHAMBERS**
droplet growth in expanding, time-dependent, (T), 20: 43674
operation of Wilson, program for recording $V^o$ events for, 20: 43740

**COAL**
analysis for ash, instrument for neutron activation methods of, 20: 43160
economics and transportation costs in U. S., 20: 45175
economics of, for generating electric power, 20: 45242 (TID-22978(Rev.))
transportation costs in Canada, 20: 45177

**COATINGS**
deposition of actinide, autoradiographic control of, 20: 43866
deposition of aluminum-alloy, on transition metals, 20: 43962
deposition of oxidation-resistant, on niobium alloys, fluidized-bed process for, 20: 43881
development for niobium and molybdenum alloys, 20: 43877
development for oxidation protection of niobium alloys at 0 to 2000°F, 20: 43827 (GTR-19)
development for oxidation protection of heat-resisting alloys, 20: 43842
development of, for fission-product iodine adsorption, 20: 45045(R) (BMI-X-10173)
performance of silicon carbide, on graphite, 20: 43825 (BNWL-242)
testing of titanate, for thermal radiators, 20: 43816(R) (PWA-2877)

**COBALT**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in plant materials, activation, 20: 43060 (CEA-R-2967)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in seawater by activation and gamma spectrometry, 20: 43059 (BNWL-SA-674)
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination in steel, effects of ions on gravimetric, 20: 43145
effects of content of, on oxidation of Hastelloy X by air at 1750°F, 20: 43838 (TID-23319)
effects on exchange of deuterium between aniline and deuterium oxide, 20: 43275
effects on photometric determination of cerium in cast iron and steels, 20: 43143
proton reactions at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
proton total cross section at 17 Mev, (E), 20: 44662 (USC-136-111)
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
separation from pitchblende residues, leaching processes for, 20: 43420 (MCW-1508)

**COBALT ALLOYS**
corrosion in oxidizing atmospheres at high temperatures, 20: 43842
development of dispersion-strengthened magnetic, 20: 43815(R) (NASA-CR-54356)
Bi–Co, superconductivity, 20: 44554
Ce–Co, crystal structure of intermetallic compound, 20: 43920
Ce–Co–Pu, corrosive effects of liquid on carburized and uncarburized niobium and tantalum alloys, 20: 43829(R) (LA-3582)
Ce–Co–Pu, density and viscosity of liquid, 20: 43889 (CONF-660606-39)
Ce–Co–Pu, development and testing as liquid fuel, 20: 43814 (LA-DC-7581)
Co–Dy, crystal structure of intermetallic compound, 20: 43920
Co–Er, crystal structure of intermetallic compound, 20: 43920
Co–Fe, alpha-to-gamma transformation temperatures, increased by additives, 20: 43815(R) (NASA-CR-54356)
Co–Fe–Ni, development of hardened martensitic, as high-temperature magnetic materials, 20: 43815(R) (NASA-CR-54356)
Co–Gd, crystal structure of intermetallic compound, 20: 43920
Co–Ho, crystal structure of intermetallic compound, 20: 43920
Co–Lu, crystal structure of intermetallic compound, 20: 43920
Co–Nb, decomposition and structure of supersaturated, 20: 43938
Co–Nd, crystal structure of intermetallic compound, 20: 43920
Co–Ni–Ti, creep testing of Nivco, 20: 43815(R) (NASA-CR-54356)
Co–Pr, crystal structure of intermetallic compound, 20: 43920
Co–Sm, crystal structure of intermetallic compound, 20: 43920
Co–Ta, decomposition and structure of supersaturated, 20: 43938
Co–Tb, crystal structure of intermetallic compound, 20: 43920
Co–Tm, crystal structure of intermetallic compound, 20: 43920

**COBALT COMPLEXES**
with bipyridine, radiation effects on, role of water of hydration in thermal annealing of, 20: 43366

**COBALT COMPOUNDS**
localization of cobalt phthalocyanine tetrasulfonate in mouse tumors, 20: 42840(R) (ANL-7136, pp 164-90)

**COBALT IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100

**COBALT ISOTOPES Co-55**
energy levels from iron-54 (He-3,d) reactions, (E), 20: 44837
gamma spectra, 20: 44634(R) (IDO-17188)

**COBALT ISOTOPES Co-57**
energy levels from iron-56 (He-3,d) reactions, (E), 20: 44837
Mössbauer spectra of, effects of heating on, (E), 20: 45033
preparation of Moessbauer source of, electrolytic cell for, 20: 43395

**COBALT ISOTOPES Co-58**
production of carrier-free, 20: 43398

**COBALT ISOTOPES Co-59**
neutron capture by, cobalt-60 energy-level transitions from thermal, (E), 20: 44729

**COBALT ISOTOPES Co-60**
content in Clinch River from ORNL waste solutions, 20: 45223
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
determination in neutron-irradiated clays and soils, 20: 43607
dosimetry of industrial source of, 20: 43621
effects on electric conductivity in rat muscle tissue, 20: 42929
effects on erythropoietic index and iron content in man, 20: 42908

effects on intestinal absorption of carbon-14-labeled L-alanine in rabbits, 20: 42972
energy-level transitions from thermal-neutron capture by cobalt-59, (E), 20: 44729
gamma spectra, 20: 44634(R) (IDO-17188)
production of, developments in commercial, 20: 43803
separation from Clinch River sediments, 20: 45216 (ORNL-3721)
sorption from waste solutions by Yazoo and Zilpha clays, 20: 45221
use as gamma source within a swimming pool reactor, 20: 43791
use as heat source in hydrospace, 20: 43797 (AGN-8163(Vol.3))
use for radiotherapy of cancers, techniques and dosimetry for, 20: 43021
use for therapy of skin metastases, 20: 43039
COBALT PHOSPHATES
precipitation of, tracer studies of formation of Liesegang rings during, 20: 43249
COBALT SYSTEMS
Co–Ni–ThO$_2$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
Co–WC, properties of sintered, effects of carbon and particle size on, 20: 43878
Co–WC, strength of, effects of hydrostatic support pressure on ultimate compressive, 20: 43909 (SC-DC-66-1888)
COILS
magnetic fields in shorted superconducting, method for reversing, 20: 44564
COINCIDENCE COUNTERS
dead time correction of counting losses in, device for automatic digital, 20: 43713
design of $\alpha$-$\beta$ and $\beta$-$\alpha$ for analysis of fission product mixtures, 20: 43158
design of low-noise anticoincidence beta, 20: 43719
development of, for interference reduction and sensitivity improvement in activation analysis, 20: 43075 (LA-DC-7931)
performance of meson ($\mu$), directional response, 20: 43678
COLORADO
population studies in, epidemiological, 20: 42700(R) (ANL-7136, pp 162-3)
serial surveying of 6500 sq. mi. Denver area of, $\gamma$, 20: 43513 (CEX-59.4.26)
COLORADO PLATEAU (COLO.)
aerial survey of Denver area, $\gamma$, 20: 43513 (CEX-59.4.26)
COLUMBIA RIVER
zinc-65 transport by, to Pacific Ocean, 20: 43545
COLUMBITES
analysis of, for niobium and tantalum by column extraction, 20: 43131
COMETS
effects on atmospheric photon flux of solar approach of Ikeya-Seki, (E), 20: 44158
COMPRESSORS
design and testing of gas-bearing turbo, for Brayton power cycle, 20: 43481(R) (NYO-3237-6)
COMPUTER PROGRAMS
AIROX, for calculating weight gain in gas–metal reactions, FORTRAN IV for, 20: 43898 (NAA-SR-Memo-11967)
Alpha M, for determining radioisotopes by least-squares resolution of gamma spectra, FORTRAN II and IV for, 20: 43078 (ORNL-3975)
AVOID, for reactivity void effects in cylindrical reactors, in FORTRAN IV, 20: 45072 (GEMP-424)
BASIC, for axisymmetric stress intensity, 20: 43467 (TID-23343)
CERL-II, for stress distribution in spherical pressure vessel with single radially attached nozzle, 20: 43491 (ORNL-P-2472)
development for determining population inbreeding coefficients and relations, 20: 42836(R) (ANL-7136, pp 109-23)
DOLTL, for temperature drift in reactivity in SNAP 10A reactors, 20: 45198 (NAA-SR-Memo-11977)
DRUTES, for design of direct radiating thermoelectric system, 20: 45195 (NAA-SR-Memo-11819)
ESELEM, for neutron group constants for fast reactors, 20: 45075 (JAERI-1109)
for APT post processor for positioning machines, 20: 45238 (K-1675)
for automatic decomposition of spectra from charged-particle reactions, FORTRAN 3600 for CDC 3600, 20: 44656 (TID-23315)
for electron-photon cascade showers, 20: 44153
for evaluation of effects of release of radioactive material, FORTRAN, 20: 43609
for gamma spectra analysis in activation analysis, 20: 43159
for isothermal rate constants for metal oxidation, FORTRAN IV for IBM 7090/7094, 20: 43172 (NAA-SR-Memo-11966)
for material buckling in subcritical assemblies, in GIER ALGOL III, 20: 45073 (INR-659/IXA/RP)
for neutron activation processes in Yankee core, 20: 45126 (WCAP-6072)
for nucleon-electron cascades, 20: 44152
for reactivity calculations in BORAX-V, 20: 45202 (ANL-6964)
for reactor burnup calculations, in FORTRAN IV, 20: 45067 (CONF-660303, pp 259-69)
for reactor fuel burnup analysis, 20: 45111(R) (HPR-68)
GRISM, for preparation of multigroup constants from microscopic neutron cross-section data, FORTRAN II for IBM 7094, 20: 44584 (NAA-SR-11980(Vol.3))
HEETR, for fast neutron distributions in enriched-uranium heavy-water lattices, 20: 45077 (MIT-2344-5)
JP-HYDRO, for hydrodynamics of natural circulating BWR, 20: 43479 (JAERI-1108)
KINAK, for BWR nuclear, thermal, and hydraulic analysis, FORTRAN IV for IBM-7044, 20: 45074 (JAERI-1107)
M-GAM, for calculation of fast-neutron spectra and multigroup constants, FORTRAN II for IBM 7094, 20: 44586 (NAA-SR-Memo-12019)
METHUSELAH II, for physics analysis of liquid-moderated reactors, 20: 45063 (AEEW-R-480)
MONACO, for gamma-ray transport, FORTRAN II for IBM-704, 20: 44987 (AD-637685)
SCAT-1, for calculating $T^{n}_{LL'}$ matrices, for Philco-2000, 20: 44663 (WAPD-TM-571)
SEAL SHELL-2 use in pressure at nozzles in thick shelled spherical pressure vessels, 20: 43467 (TID-23343)
STRELA, for flow rating in boundary layers, 20: 44406
UNCOL, for fast neutron distributions in enriched-uranium heavy-water lattices, 20: 45077 (MIT-2344-5)
UPSTART, for SNAP reactor control and stability analysis, 20: 45196 (NAA-SR-Memo-11894)
use for analysis of counting data on radioisotope mixtures, FORTRAN, 20: 42698(R) (ANL-7136, pp 80-94)
2-PLUS, for calculation of fast-neutron scattering cross sections, FORTRAN II for IBM 7094, 20: 44645 (NAA-SR-11706)
COMPUTERS
data preparation, for reactor calculations, 20: 44583(NAA-SR-11980(Vol.1))
data storage systems for nucleon codes, secondary, 20: 43804 (LA-3546)
description of, for bubble chamber film processing, 20: 43676
design for data handling for liquid scintillation spectrometers, 20: 43749(P)
use for chromosome characterization and pairing, 20: 42837(R) (ANL-7136, pp 124-40)
use for dosimetry calculations for sealed radioisotope therapeutic sources, 20: 43021
use for epidemiological studies in human populations, 20: 42700(R) (ANL-7136, pp 162-3)
use for evaluating radiological hazards at NRTS, 20: 43609
use for Hanford N-Reactor operations analysis, 20: 45191 (RL-GEN-1058)
use for measurement of fast neutron absorbed dose in tissues, 20: 43668(R) (ANL-7136, pp 1-16)
use for positioning machines, 20: 45238 (K-1675)
use for regression analysis of biological parameters, 20: 43051
use in nuclear power plant construction, PERT planning method for, 20: 45161
use of analog and digital, for pseudo-random binary signal analysis for JRR-3, 20: 45213
use of analog, for simulation of Fermi reactor, 20: 45168
use of GE 225 for analysis of gamma spectra, 20: 43512(R) (ANL-7136, pp 315-27)
use of GE 225, for analysis of biological data, 20: 42698(R) (ANL-7136, pp 80-94)
CONCRETES
effect of prestressing steel used in, 20: 43456(T) (ORNL-tr-1348)
gamma attenuation in, tables of equivalent thickness of, 20: 44989
iron armature thicknesses in, gamma absorption method for measuring, 20: 43762
neutron albedo for limestone, fast, 20: 44988 (NASA-TM-X-1287)
radiation effects on refractory, neutron, 20: 44005
radioactivity in raw materials, 20: 43514 (UCRL-16878)
shielding properties of, against fallout, 20: 43568 (AD-636787)
CONNECTICUT YANKEE POWER REACTOR
control system set point analysis for, 20: 45115 (NYO-3250-7)
CONNECTIVE TISSUE
development of mast cells in adult and fetal rats, 20: 42834(R) (ANL-7136, pp 46-63)
radiation effects on cultured neoplastic mast cells, x, 20: 42834(R) (ANL-7136, pp 46-63)
CONNECTORS (ELECTRIC)
radiation effects on, for SNAP 8, 20: 45194 (NAA-SR-11924)
CONTAMINATION
effects of Kiwi reactor on environmental, 20: 43576 (CONF-660621-7)
hazards from radioactive, of surface waters, 20: 43598
levels of radioactive, in biological materials, 20: 43596
plutonium, in production areas, particle size studies, 20: 43595
protection from, using plastics, 20: 43471
removal of greasy, soapy, soluble, nonsoluble or metallic, method of,

20: 43599

**CONVECTION (FORCED)**
- oscillations in, thermal-acoustic, 20: 43480 (LA-3543)

**CONVERSION ELECTRONS**
- spectra from europium- and promethium-149 decay, 20: 45046(R) (IDO-17192)

**CONVEYERS**
- design for air monitoring equipment, 20: 43751(P)

**COPPER**
- coating with thallium, 20: 43400
- determination by charged-particle reactions at 2 Mev, 20: 43097
- determination in aluminum–copper alloys using EDTA, chelometric, 20: 43069(R) (IDO-14679, pp 51-9)
- determination in boron by x-ray fluorescence, 20: 43091 (UCRL-14879)
- determination in plant materials, activation, 20: 43060 (CEA-R-2967)
- determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
- determination in seawater, activation, 20: 43085(R) (TID-23295, Sect.2)
- determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
- determination of trace amounts of, in tungsten and molybdenum by atomic absorption spectrophotometry, 20: 43154
- determination of, in carbazole by neutron activation methods, 20: 43116
- determination of, by isotopic dilution and radioactivation analysis, 20: 43137
- effects on superconductors from pressure contacts, 20: 44526
- electron and positron emission from copper-64 embedded in single crystals of, 20: 45019
- electron and proton diffraction channelling in crystals of, fast, 20: 44134
- electron scattering at 3.5 to 14.1 Mev on, backscattering from, (E), 20: 44115
- electron scattering at 3.2 to 14.1 Mev, backscattering energy distributions from, (E), 20: 44116
- heat transfer in packed beds of, in stagnant air, 20: 43483(R) (RPI-3639-1)
- nuclear magnetic fields in iron, (E), 20: 44824
- proton total cross section at 17 Mev, (E), 20: 44662 (USC-136-111)
- radiation effects on deformation structure of, neutron, 20: 44003
- radiation effects at cryotemperatures on, recovery rates of electron, 20: 44022
- radioinduced defects in, recovery from, (E/T), 20: 45040
- radioinduced strengthening of single crystals of, mechanism of, neutron, 20: 45030
- radioinduced strengthening of single crystals of, mechanism of, neutron, 20: 45031
- radioinduced strengthening of single crystalsof, mechanism of, neutron, 20: 45032
- seperation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
- separation from pitchblende residues, leaching processes for, 20: 43420 (MCW-1508)
- sputtering by argon ions at 5 kev, scanning spectrometer for determining yields from, 20: 43660
- use in G-M counters with activable cathodes, for measurement of fast neutron fluxes, 20: 43729

**COPPER ALLOYS**
- Al–Cu, analysis for aluminum and copper using EDTA, chelometric, 20: 43069(R) (IDO-14679, pp 51-9)
- Al–Cu, radiation effects on deformation structure of, neutron, 20: 44003
- Bi–Cu, superconductivity, 20: 44554
- Cu–Ni–W, ductility and tensile properties of tungsten-base, 20: 43822
- Cu–U, combustion kinetics of, 20: 43612
- Cu–U, oxidation of uranium-base, kinetics at 300 to 625°C, 20: 43841

**COPPER COUPLES**
- Al/Cu, corrosion by water at 50°C, 20: 43824 (ANL-6236)

**COPPER IONS**
- effects on cobalt determination in steel, 20: 43145
- effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
- spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**COPPER ISOTOPES Cu-59**
- energy levels from nickel-58 (He-3,d) reactions, (E), 20: 44837

**COPPER ISOTOPES Cu-61**
- energy levels from nickel-60 (He-3,d) reactions, (E), 20: 44837

**COPPER ISOTOPES Cu-63**
- separation from neutron-deficient zinc-62, 20: 43067(R) (IDO-14679, pp 6-46)

**COPPER ISOTOPES Cu-64**
- content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
- nuclear magnetic fields in iron, (E), 20: 44824

**COPPER ISOTOPES Cu-65**
- meson (π) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720

**COPPER OXIDES**
- radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
- $CuO–Cu_2O–ZrO_2$, phase studies, 20: 43978

**COPPER SULFATES**
- analysis of pure sulfuric acid solutions of, by beta reflection method, 20: 43142
- corrosive effects on aluminum and aluminum alloys, 20: 43824 (ANL-6236)
- effects of injections on protein fractions in serum of irradiated rabbits, 20: 42870
- effects on radiolysis of cyclohexane in aqueous solutions, 20: 43357

**CORROSION**
- measurement of, use of Kryptonate beta sources in, 20: 43765

**CORROSION LOOPS**
- development of potassium, sodium, and potassium–sodium, analysis, handling, and purification studies for, 20: 43083 (R-66SD3012)
- development of refractory-alloy potassium, 20: 43830(R) (NASA-CR-72029)
- development of refractory-alloy potassium, 20: 43831(R) (NASA-CR-72057)
- operation of niobium–zirconium alloy with 2000°F/1000°F lithium, 20: 43837 (TIM-823)

**CORTICOSTEROIDS**
- radioinduced inactivation of 17-oxy-, in dog liver, γ, 20: 42808

**CORTISONE**
- effects on antigenicity of bone marrow transplants in mice, 20: 42995
- effects on mouse immunity to sarcoma J, 20: 42890
- use with x-radiation to suppress immune response in human kidney transplantation, 20: 43032

**COSMIC ALPHA PARTICLES**
- polar cap absorption by ionizing effect of, analysis by corrected geomagnetic coordinates, (E), 20: 44472

**COSMIC ELECTRONS**
- effects on primitive Earth atmosphere, formation of sulfur-containing amino acids by, 20: 42726

**COSMIC MESONS**
- directional distribution of, geomagnetic and solar activity effects on, 20: 44422
- intensity in direction of earth's rotation axis, anisotropy of, 20: 44475
- intensity variations over 20-yr period, 27-day diurnal, 20: 44154
- sidereal anisotropy of, two-way, 20: 44159

**COSMIC MESONS (μ)**
- detection and measurement of, telescope directional response in, 20: 43678
- production height in air showers, geomagnetic field effect on, (T), 20: 44418

**COSMIC NEUTRONS**
- attenuation and multiplicity distribution of, correlated with atmospheric pressure, 20: 44424
- intensity in direction of earth's rotation axis, anisotropy of, 20: 44475
- intensity, latitude effect on, (E), 20: 44423

**COSMIC NUCLEONS**
- attenuation length, solar cycle effect on, 20: 44425
- interactions at energies $\geq 10^{11}$ ev, passive nucleon state in, (T), 20: 44162
- reactions with nuclei above $10^{12}$ ev, angular distribution of secondaries from, (E), 20: 44286

**COSMIC PARTICLES**
- effects on radio wave scattering in ionosphere, 20: 44157
- ejection in solar flares, relation to geomagnetic sudden commencements, 20: 44466

**COSMIC PHOTONS**
- absorption within radio sources of high-energy, 20: 44084
- detection and source location for $30 \leq E \leq 500$ Mev, 20: 44947
- flux effects of solar approach of Ikeya-Seki, (E), 20: 44158
- reactions in atmosphere, delta electrons from, 20: 44156

**COSMIC PROTONS**
- polar cap absorption by ionizing effect of, analysis by corrected geomagnetic coordinates, (E), 20: 44472
- reactions in atmosphere, delta electrons from, 20: 44156
- reactions with solar flare nuclei, gamma production in, 20: 44093

**COSMIC RADIATION**
- absorption of r-f noise in ionosphere, (E/T), 20: 44478
- attenuation of nucleonic component, solar cycle variation in, 20: 44425
- detection and measurement at high altitudes, aircraft instrumentation for, 20: 44417 (LA-DC-7837)
- detection and measurement of gamma, design and performance of spark chambers for, 20: 43734
- detection of, scintillation detector system for measuring, 20: 43687
- effects on chromosomes in roots of higher plants, 20: 42909
- effects on crystal lattices, 20: 43987 (BNL-10569)
- effects on phage induction and viability in *E. coli* during space flight,

20: 42910
effects on phage induction and viability in *E. coli* treated with β-mercaptopropylamine, 20: 42911
energy of, total, 20: 44156
energy spectra and flux of low-energy heavy nuclei of primary, (E), 20: 44458
energy spectra of primary, upper limit of, 20: 44155(T)
intensity in direction of earth's rotation axis, anisotropy of, 20: 44475
intensity recovery after Forbush decreases, 20: 44421
intensity variations of, daily, 20: 44161
interactions with achondrites, xenon isotope mass yield from, 20: 44079
nucleon interactions at energies $\geq 10^{11}$ ev, passive nucleon state in, (T), 20: 44162
reactions at sea level, measurement of ionization from, 20: 44456
sodium-22 and production by, 20: 43546
spectral distribution of, time rate of change in, 20: 42706(R) (NYO-2373-1)
variations of charged, anisotropy in sidereal daily, 20: 44159

**COSMIC SHOWERS**
intensity recovery after Forbush decreases, 20: 44421
intensity variations of, correlation of sudden commencement and Forbush decreases with, (E), 20: 44419
meson (μ) production in photon-electron, at sea-level, 20: 44160
production height of muons in, geomagnetic field effects on, (T), 20: 44418

**COSMOLOGY**
antiparticles in, 20: 44282
evolution of universe, red-shift measurements for, 20: 44092
gravitation equation in, singularities in, 20: 44107
model of universe, effect of quarks on, 20: 44089
particle-antiparticle abundances in universe, symmetry between, 20: 44097

**COTTON**
radiation effects on morphology of plants, gamma, 20: 42896
radiation effects on fat and starch content of pollen, gamma, 20: 42896
radiation effects on reproductive organs of, on yield, gamma and thermal neutron, 20: 42899
radioinduced graft polymerization of styrene on fibrous, 20: 43299
radioinduced polymerization of acrylonitrile with cyanoethylated, 20: 43348
radioinduced polymerization of styrene on, 20: 43349

**COUNTING DEVICES**
description of accumulator and ring, using transistors and tunnel diodes, 20: 43654
design of whole-body, for detecting low concentrations of gamma-emitting nuclides, 20: 43022

**CRATERS**
formation by multiple-row charge in basalt rock, 20: 43461 (PNE-607F)

**CREATINE**
radioinduced excretion of, in adrenalectomized rats, γ, 20: 42801

**CREEP**
model for polycrystalline thoria at high temperatures, 20: 43941
prevention of, by heat treatment of steel, 20: 43456(T) (ORNL-tr-1348)

**CRITICAL ASSEMBLIES**
description of U. S. facilities, 20: 45052 (TID-8200(14th Rev.))
development of ZPPR, 20: 45106(R) (ANL-7249)
fast neutron distributions in enriched-uranium heavy-water lattices, 20: 45077 (MIT-2344-5)
fuel fabrication for Re-Suco, 20: 43872
heat output shaping in, effect of fuel distribution on, 20: 45208
multiplication factors for, Monte Carlo determination of, 20: 45076 (K-DP-1637)
neutron parameter measurements in SNEAK-2, 20: 45207(T) (EURFNR-76F)
reactivity measurements in ZPR-6 assembly 5, sodium void effects on, 20: 45106(R) (ANL-7249)

**CRITICALITY STUDIES**
fission yields of supercritical volume of uranyl nitrate solutions, effects of reactivity addition rate and weak neutron source on, 20: 43618
of BORAX-V, 20: 45202 (ANL-6964)
of enriched uranium heavy-water lattices, 20: 45084

**CRUSTACEA**
ecology of Northeast Pacific Ocean, tracer study, 20: 42731(R) (RLO-1751-2)
radiation effects on, lethal α, β, γ, and x, 20: 42934

**CRYOSTATS**
design of, 20: 44501 (CEA-R-3008)

**CRYSTAL STRUCTURE**
book: *Electron and Ion Processes in Solids*, 20: 43265
determination of borate glass, by radioinduced optical density, 20: 44010
dislocations in chromium–uranium alloy, model of, 20: 43955
radiation effects, automatic instrumentation for x-ray diffraction intensity measurements of, 20: 43646
temperature effects on alpha-zirconium, 20: 43956

**CRYSTALS**
analysis of, tables for x-ray fluorescence, 20: 43057 (AAEC-TM-321)
charged particle interactions in, directional effects during, (T), 20: 4499 (BNL-10544)
electron paramagnetic resonance spectra at 4.2°K, design of resonator for observation of, 20: 43721
excitations in, Goldstone theory for, 20: 45042
radioinduced defects in, effects on phase transformation points of, (T), 20: 45034

**CUMENE**
decomposition of, on gamma-irradiated silica gel, at −196°C, 20: 43319
decomposition of, effects of radioactive tricalcium phosphate catalyst on, 20: 43391

**CURCUMIN**
use in spectrophotometric determination of boron in synthetic materials, 20: 43067(R) (IDO-14679, pp 6-46)

**CURIUM**
separation of, from cesium and zirconium by paper electrophoresis, 20: 43451

**CURIUM IONS**
electromigration of trivalent, in sodium hexametaphosphate during paper electrophoresis, 20: 43451

**CURIUM ISOTOPES Cm-242**
distribution from nuclear explosion in salt deposit, 20: 43802
separation from americium, electrolytic and ion exchange, 20: 43453

**CURIUM ISOTOPES Cm-244**
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)
use as isotopic heat source, criticality considerations in, 20: 44628 (CONF-660303, pp 964-70)

**CUTTING TOOLS**
development of remotized hydraulic bolt cutter for irradiation capsules, 20: 43470 (UCRL-14743)

**CYANIDES**
radioprotective effects on mice and rats, reaction mechanisms for, 20: 42998(R) (EUR-2992.f)

**CYANOCHROMATES**
spectra of aqueous solutions of ionic, ESR, 20: 43184 (UCRL-17064)

**CYCLOBUTANE, OCTAFLUORO-**
effects on hydrogen yields in gamma radiolysis of cyclohexane and hexane, 20: 43316

**CYCLOHEXANE**
radiolysis of aqueous solutions of, effects of hot hydrogen atoms on, 20: 43357
radiolysis of, effects of perfluorocarbons on hydrogen yields in gamma, 20: 43316
radiolysis of, formation of methyl cyclohexyl ketone in, 20: 43361
acetone–cyclohexane, radiolysis of, effects of air on, 20: 43361
acetyl chloride–cyclohexane–cyclohexene, radiolysis of, effects of acetyl radical on, 20: 43361
acetyl chloride–cyclohexane, radiolysis of, methyl cyclohexyl ketone yields in, 20: 43361

**CYCLOHEXANE, DODECAFLUORO-**
effects on hydrogen yields in gamma radiolysis of cyclohexane and hexane, 20: 43316

**CYCLOHEXANE, UNDECAFLUORO(TRIFLUOROMETHYL)-**
effects on hydrogen yields in gamma radiolysis of cyclohexane and hexane, 20: 43316

**CYCLOHEXANONE**
hydrogen abstraction from, by *tert*-butoxy radicals, effects of deuterium on, 20: 43284

**CYCLOHEXENE**
radiolysis of, addition reactions of double bond during, 20: 43361
acetyl chloride–cyclohexane–cyclohexene, radiolysis of, effects of acetyl radical on, 20: 43361

**CYCLOPENTADIENYL COMPOUNDS**
with neptunium chloride, preparation and properties of, 20: 43230

**CYCLOTRON RADIATION**
absorption from relativistic electrons, negative re-, 20: 44040
emission from intense magnetic fields, (T), 20: 44061
motion of, degeneracy of, (T), 20: 44913

**CYCLOTRONS**
beam deflector for Rossendorf, automatic, 20: 44050
beam extraction from six-sector isochronous, use of ⅔-radial resonance for, 20: 44054
ion source of U-120, modification for negative hydrogen ion production, 20: 44056

**CYLINDERS**
gamma heating in infinite, with uniformly distributed sources, 20: 45050 (ORNL-TM-1260)
size of, equipment for measuring, 20: 43474(P)
stress analysis of hollow circumferentially notched round bars, 20: 43912 (UCRL-14859)

**CYSTEIC ACID**
formation during electron irradiation of primitive Earth atmosphere, tracer studies of, 20: 42726
**CYSTEINE**
formation during electron irradiation of primitive Earth atmosphere, tracer studies of, 20: 42726
protective effects against alpha and gamma radiation of enzymes, 20: 42816
radioprotective effects on mice and rats, reaction mechanisms for, 20: 42998(R) (EUR-2992.f)
radiosensitivity effects on mice from intravenous or oral injection in gum arabic solution, x, 20: 42997(R) (ANL-7136, pp 191-204)
aminobutyric acid hydrochloride–cysteine hydrochloride, radiation effects on spin transfer in single crystals of, 20: 43317
**CYSTINE**
formation during electron irradiation of primitive Earth atmosphere, tracer studies of, 20: 42726
protective effects against alpha and gamma radiation of enzymes, 20: 42816
**CYTIDINE**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
**CYTIDINE, 2′-DEOXY-**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
**CYTIDYLIC ACIDS**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
**CYTOLOGY**
abstracts of studies on, 20: 42719(R) (UR-49-687, pp 117-31)
origin of DNA in cytoplasmic organelles, tracer study, 20: 42701(R) (ANL-7136, pp 205-30)
radiobiological and radiochemical processes involved in cell death, mechanisms of, 20: 42821
radioinduced degeneration of retinal cells of rabbits, electron microscope studies, 20: 42958
**CYTOPLASM**
origin of DNA in organelles of, tracer study, 20: 42701(R) (ANL-7136, pp 205-30)
**CYTOSINE**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

## D

**DATA RECORDING SYSTEMS**
design for evaluating radiological hazards, 20: 43609
design for sediment gage, 20: 43561
development for Hanford N-Reactor operation, 20: 45191 (RL-GEN-1058)
use in nuclear medicine, 20: 43051
**DATA TABULATIONS**
beta-particle energies of radioisotopes, tables of maximum, 20: 44655 (SZS-4/66)
carbon-14 age estimates for 1966, 20: 43560
cross sections for neutron inelastic scattering by nuclei with Z = 3 to 92, 20: 44668(T) (INDSWG-101, pp 73-108)
cross sections for neutron elastic scattering by nuclei with Z = 13 to 92, 20: 44669(T) (INDSWG-101, pp 109-57)
cross sections for neutron reactions with nuclei from Z = 13 to 28, with charged-particle emission, 20: 44671(T) (INDSWG-101, pp 164-223)
neutron resonance parameters for nuclei with Z = 18 to 95, 20: 44667(T) (INDSWG-101, pp 23-72a)
spectra of neutron-deficient nuclides, 20: 44634(R) (IDO-17188)
**DECONTAMINATING SOLUTIONS**
efficiency of, for plant surfaces, effects of surface-active agents on, 20: 43579 (INR-725/XXII/C)
**DECONTAMINATION**
bibliography on methods and equipment for, 20: 43569 (AED-C-13-04)
method for radioactive, of ground water recharge, 20: 43522
methods of, for metallic surfaces, 20: 43599
of gases in solid waste incineration plants, 20: 45214 (AEET-243)
of solutions, aluminum silicate properties for ion-exchange, 20: 43449
of structures during postattack period, 20: 43567 (AD-635820)
ultrasonics in metal, 20: 43623
use of foams for, of air containing radioiodine and particulates following nuclear incidents, 20: 43585 (ORNL-TM-1589)
**DEER**
cesium-137 content in reindeer meat in Sweden, 20: 42736
**DEHYDROGENASES**
radiation effects on activity of glucose-6-phosphate, in rat bone marrow, x, 20: 42788
radiation effects on yeast, alpha and gamma, 20: 42816
**DENMARK**
waste processing at Risö Research Establishment in, vitrification process for, 20: 45230
**DENSITOMETERS**
catalog of Russian radiometric, 20: 43639(T) (AEC-tr-6633)
design of radiometric, for sediment monitoring, 20: 43561
properties of gamma, (T), 20: 43647
**DETERGENTS**
effects on decontamination of plant surfaces, 20: 43579 (INR-725/XXII/C)
**DETONATION WAVES**
effects of underground explosion, on near-surface spallation, 20: 43462 (UCRL-13225)
propagation from chemical blasts, 20: 43461 (PNE-607F)
properties and use for energy conversion, 20: 44174
**DEUTERIOBROMIC ACID**
DBr–H, photolysis of, energy threshold and reaction cross section for uv, 20: 43289 (CALT-532-2)
**DEUTERIOIODIC ACID**
DI–H, photolysis of, cross section and threshold energy calculations for, 20: 43288(R) (CALT-532-1)
DI–H, photolysis of, energy threshold and reaction cross section for uv, 20: 43289 (CALT-532-2)
**DEUTERIUM**
determination in reactor blanket gas, design of continuously operating gas chromatogram for, 20: 43157
deuteron reactions (d,n) with, associated-particle method for use as neutron source, (E), 20: 44813
diffusion in palladium and palladium alloys, measurement of, 20: 43934
diffusion in palladium and palladium–silver alloys, effects of pressure and temperature on, 20: 43935
distribution in products from metal-catalyzed reactions on substituted ethylenes, 20: 43279
effect on reaction of *tert*-butoxy radicals with aliphatic ketones, 20: 43284
effects on formation of hydrogen in radiolysis of water, 20: 43352
effects on optical purity of primary alcohols, 20: 43254
effects on reaction kinetics, role of force constant changes in, 20: 43227
effects on thermal decomposition of 1,1′-diphenylazoethane in ethylbenzene, 20: 43278
exchange between aniline and deuterium oxide, effects of temperature and catalytic activity of cobalt, nickel, and platinum on, 20: 43275
exchange between heterocyclic nitrogen compounds and ammonia, effects of ring position on, 20: 43216
exchange with hydrogen, in palladium, effects of pressure and temperature on, 20: 43236
exchange with hydrogen on tungsten at 77 to 473°K, desorption spectra studies of, 20: 43255
fission fragment energy-losses in, (E), 20: 44685
incorporation in acetylene and ethylene, 20: 43409(P)
ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122
isotopic exchange with hydrogen over palladium hydride, at −195 to −183°C, 20: 43232
neutron capture by, calculations with elastic unitarity and nonsymmetric three-body wave functions, (T), 20: 44748
neutron cross sections from 0.037 ev to 18 Mev, tables of, 20: 44661 (UNC-5139)
proton reactions (p,$\gamma$) with, calculations with elastic unitarity and nonsymmetric three-body wave functions, (T), 20: 44748
separation from deuterium on palladium, effects of pressure and temperature on, 20: 43236
sorption by palladium hydride at −195 to −183°C, 20: 43232
spectra in ribonuclease and its histidine residues, PMR, 20: 43281
**DEUTERONS**
angular distribution from calcium-40 ($\alpha$,d) reactions at 24.8 Mev, (E), 20: 43717
binding energy determination, 20: 45046(R) (IDO-17192)
effects on superconducting properties of niobium–zirconium alloys, 20: 44505
interactions with mesons ($\pi^+$) at 1.2 and 2.8 Bev/c, cross section for $Z^+$ baryon production in, (E), 20: 44195
interactions with mesons ($\pi$), relativistic impulse approximation for elastic, 20: 44210
interactions with deuterons at 21.4 Mev, polarization angular distributions from elastic, (E), 20: 44231
interactions with protons at 135 Mev, parameters for elastic, (E), 20: 44233
interactions with nucleons, differential cross sections for inelastic, (T), 20: 44275
interactions with electrons, CP violation in elastic, 20: 44279
photodisintegration in Coulomb fields of heavy nuclei, as three-body problem in quantum mechanics, (T), 20: 44827

reactions (d,α) with oxygen-18 at 11.98 Mev, nitrogen-16 energy levels from, 20: 44730
reactions (d,α) with magnesium-24 at 4.5 to 10 Mev, excitation function of, (E), 20: 44768
reactions (d,α) with carbon-12, differential cross sections for, (T), 20: 44826
reactions (d,α) with silicon-28 at 6.98 to 9.86 Mev, isospin selection rule in, (E), 20: 44841
reactions (d,He-3) with zirconium-90 at 34.4 Mev, spin dependence of angular distributions from, (E/T), 20: 44880
reactions (d,n) with beryllium-9, carbon-13, and magnesium-25, (E), 20: 44601(R) (ANL-7218)
reactions (d,n) with lithium-7 at 200 kev, beryllium-8 energy levels from, (E), 20: 44677
reactions (d,n) with deuterium, associated-particle method for use as neutron source, (E), 20: 44813
reactions (d,n) with argon-36, potassium-37 energy levels from, (E), 20: 44838
reactions (d,n) with gases, determination of carbon, nitrogen, and oxygen using, 20: 43115
reactions (d,pn) with carbon-12 at 5.39 Mev, 20: 44731
reactions (d,p) and (d,t) with xenon-135, xenon-136 and xenon-137 energy levels from, (E), 20: 44842
reactions (d,p) with magnesium-25 at 8.0 Mev, magnesium-26 energy levels from, (E), 20: 44725
reactions (d,p) with nitrogen-15 at 11.98 Mev, nitrogen-16 energy levels from, (E), 20: 44730
reactions (d,p) with magnesium-24 at 5 and 6 Mev, (E), 20: 44737
reactions (d,p) with magnesium-24 at 2.8 to 6.1 Mev, cross-section fluctuations in, (E), 20: 44738
reactions (d,p) with even-even spherical nuclei, vibrational energy levels from, (E/T), 20: 44797
reactions (d,p) with magnesium-24 at 10 Mev, testing T invariance by, 20: 44805
reactions (d,p) with oxygen-16 at 6.00 to 8.55 Mev, oxygen-17 energy levels from, (E), 20: 44835
reactions (d,p) with calcium-40 at 11 Mev, proton polarization in, (E), 20: 44839
reactions (d,t) and (d,He-3) with calcium-40, carbon-12, and nitrogen-14, cross sections for, (E), 20: 44794
reactions with aluminum at 5 to 12 Mev, stopping power in, (E), 20: 44034
reactions with carbon-12 at 12.4 Mev, angular distribution of products from, (E), 20: 43717
reactions with nuclei, elemental surface analysis by, 20: 43097
scattering by light nuclei, isospin effects in elastic, 20: 44834
scattering by nuclei, optical model for elastic, (T), 20: 44846
scattering of polarized, by helium-4 at 18 and 22 Mev, elastic, (E), 20: 44750

**DIABETES**
radiotherapy of, dose- effect curve for pituitary ablation in alpha, 20: 43016(R) (UCRL-16246, pp 58-65)

**DIACETAMIDE, *N*-FLUORENYL-**
effects on rats, co-carcinogenic with fission neutrons, 20: 42840(R) (ANL-7136, pp 164-90)

**DIARRHEA**
origin and treatment of radioinduced, 20: 42994

**DIDECYLAMINE**
benzene–didecylamine–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
benzene–didecylamine–$Na_2SO_4$–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, interface and transferring species in, 20: 43424 (ORNL-P-2359)

**DIELECTRICS**
radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)

**DIET**
cesium-137 content in Chicago, Ill., 1965, 20: 43512(R) (ANL-7136, pp 315-27)
effects of calcium and phosphorus content in, on strontium-85 retention in swine, 20: 42739(R) (COO-1339-3)
radionuclide content in, estimation for populations, 20: 43573 (CONF-765-13)

**DIETHYLAMINE**
solvent properties for niobium and tantalum, 20: 43446

**DIETHYLAMINE, 2,2'-DICHLORO-N-METHYL-**
*N*-oxide, effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775

**DIFFUSION**
meterological model for radionuclide, 20: 45219
radiation-enhanced, in solids, (T), 20: 44002

**DIFFUSION PUMPS**
development of pre-heated, 20: 43498

**DIGOXIN**
preparation of tritium-labeled, 20: 42722

**DILATOMETERS**
design for cladding tubes, 20: 43960
development of high-temperature, for plutonium fuels, 20: 43811(R) (BNWL-269, pp 1.1-28)

**DILATOMETRY**
method for alpha-phase zirconium, 20: 43956

**DIODES**
use of tunnel, in electronic counters, 20: 43654

**DIODRAST**
labeling with iodine-131, 20: 43397

**DIPHENYLAMINE, *N*-METHYL-**
solvent properties for niobium and tantalum, 20: 43446

**DISCONNECTS**
design of, for Transuranium Processing Plant, 20: 43425 (ORNL-P-2406)

**DISEASES**
control and pathology of viral, in domestic animals, 20: 42954
etiology and pathology of glomerulonephritis in rats and sheep, 20: 42855(R) (TID-23203)
problems of infectious, in postattack environment, 20: 43588 (RM-5090-TAB)
radiodiagnosis of lung, using iodine-131- or isomeric technetium-99-labeled albumin, 20: 42797
radioinduced keratoconjunctivitis, in cattle, uv, 20: 42863

**1-DODECANETHIOL**
radiolysis of, yields from gamma, 20: 43345

**DOGS**
acceleration tolerance of, effects of radioprotective agents on, 20: 43004
cerium-144 metabolism and toxicity in, 20: 42836(R) (ANL-7136, pp 109-23)
cesium-137 metabolism and toxicity in, 20: 42836(R) (ANL-7136, pp 109-23)
deuterium oxide ($D_2O$) distribution in intestinal tissues of, *in vitro*, compartmental analysis of, 20: 42748
effects of dipyridamole-induced vasodilatation on coronary blood circulation in, tritiated water tracer of, 20: 42763
effects of feeding radiopasteurized meat on vitamin metabolism, 20: 42793
electron beam dosimetry in, using lithium fluoride thermoluminescent detectors, 20: 43747
gastrointestinal time in, for ceramic spheres containing manganese-54, scandium-46, or uranium carbide particles, 20: 42740 (LA-DC-7764)
growth patterns of beagle, 20: 42836(R) (ANL-7136, pp 109-23)
immune reactions to skin grafts, effects of strain on, 20: 42836(R) (ANL-7136, pp 109-23)
lymphoid cell function studies using autoradiography, 20: 42784
radiation effects in, induction of specific lymphopenia by intravascular yttrium-90 implants, 20: 42902
radiation effects on blood serum proteins after intraarterial exposure, β, 20: 43013(R) (ORO-2459-1)
radiation effects on blood lymphocyte content in, following extracorporeal γ exposure, 20: 43013(R) (ORO-2459-1)
radiation effects on immune reactions in, following extra-corporeal γ exposure of blood, 20: 43013(R) (ORO-2459-1)
radiation effects on bone marrow stem cells in, effects on survival after exposure to lethal doses of x, 20: 42844 (BNL-10385)
radiation effects on innervation system of brain meninges in, 20: 42881
radiation effects on, protective effects of typhoid-paratyphoid vaccines against x, 20: 42987
radioinduced oxycorticosteroid inactivation in liver of, γ, 20: 42808
recovery from radiation injury as evaluated by split-dose technique, 20: 42996
renal angiography using iodinated emulstion, 20: 43024
rubidium-86 uptake and distribution in heart tissues of, mechanisms of, 20: 42749
strontium-90 content in hair of beagle, on chronic ingestion regimen of the radionuclide, 20: 42780
tapetum in eyes of, morphology, incidence, and inheritance, 20: 42837(R) (ANL-7136, pp 124-40)
uranium dioxide clearance from lungs of, 20: 42767

**DOSIMETERS**
abstracts on, 20: 43591(R) (UR-49-687, pp 132-47)
bibliography on radiophotoluminescence, 20: 43689
development of personnel neutron, 20: 43671 (ORNL-P-2467)
performance of ceric sulfate ferrous sulfate, 20: 43668(R) (ANL-7136, pp 1-16)
performance of lithium fluoride, 20: 43747
radiobiological studies, 20: 43625
sensitivity of glass-base gamma SGD-8 and gamma-neutron L-15 with radioinduced optical density changes, 20: 43679
use of Fricke, with cobalt-60 well irradiator, 20: 43613
use of multisphere neutron, in mixed radiation fields, 20: 43673 (PPAD-596-E)

**DOUNREAY FAST REACTOR**
performance, 20: 45158
**DROPS**
growth in expanding cloud chambers, time-dependent, (T), 20: 43674
**DROSOPHILA**
cytology of gonads of male, 20: 42847(R) (NP-16176)
radiation effects on population dynamics in, x, 20: 42922
radiation effects on the brown-spots character of, x, 20: 42945
radioinduced X-autosomal translocations in, 20: 42709(R) (TID-23233)
**DRUGS**
effects of alkylating, on development of autoimmunity following therapeutic use, 20: 43027
effects of Azathioprine or prednisone on survival of renal homografts in dogs, 20: 43013(R) (ORO-2459-1)
effects of dipyridamole on coronary blood circulation in dogs, tritiated water tracer of, 20: 42763
effects of Leukeran and triethylene malamine on leukemia, 20: 43014(R) (RLO-581-10, pp 33-6)
effects of Mexaform S on intestinal bacteria of patients, 20: 42994
Merphyrin, effects on zinc-65 uptake by Ehrlich ascites cells *in vitro*, 20: 42775
radiosensitivity effects of antithyroid, on DNA synthesis in rat thyroids, $\beta$, 20: 42857(R) (TID-23228)
therapeutic use of Peteosthor for tuberculosis of bones and joints, 20: 43046
Toyomycin, effects on zinc-65 uptake by Ehrlich ascites cells *in vitro*, 20: 42775
tritium-labeled digoxin, a cardiac glycoside, preparation of, 20: 42722
use of immunosuppressive, and x radiation in control of immune response to transplanted human kidneys, 20: 43032
**DUSTS**
health hazards from plutonium oxide, during reactor fuel manufacture, 20: 43630
**DYES**
analytical use of tartrazine and thymol blue in qualitative analysis of tetravalent and trivalent cerium mixtures, 20: 43122
reactions of boropyrocatechin violet with lanthanum, properties of complex formed in, 20: 43223
**DYSPROSIUM**
determination of, gravimetric, 20: 43140
ionization potentials of, electron-impact method for measuring, 20: 43235
reactions with organic acids, 20: 43140
separation from other rare earths, as chloromandelate, 20: 43140
**DYSPROSIUM ALLOYS**
Al–Dy, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Dy, crystal structure of intermetallic compound, 20: 43920
Dy–Mn, crystal structure of intermetallic compound, 20: 43918
**DYSPROSIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
**DYSPROSIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with glycolic and lactic acids, thermodynamic properties of, 20: 43215
**DYSPROSIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218
**DYSPROSIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
fluorescence of trivalent, in sodium tungstate solution, 20: 43211
fluorescence of trivalent, in potassium oxalate solution, 20: 43212
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
preparation of cerium oxide single crystals containing, (E), 20: 43818
**DYSPROSIUM ISOTOPES**
determination of recoil atoms of, by measurements of diffusion in tantalum plate, 20: 43073 (JINR-P-2804)
energy levels of, rotational, (T), 20: 44843
**DYSPROSIUM ISOTOPES Dy-153**
conversion electron spectra, (E), 20: 44639 (JINR-P-2729)
**DYSPROSIUM ISOTOPES Dy-155**
conversion electron spectra, (E), 20: 44639 (JINR-P-2729)
**DYSPROSIUM ISOTOPES Dy-157**
conversion electron spectra, (E), 20: 44639 (JINR-P-2729)
**DYSPROSIUM ISOTOPES Dy-160**
energy levels of, octupole vibrational, (T), 20: 44825
**DYSPROSIUM ISOTOPES Dy-161**
gyromagnetic ratios, (E/T), 20: 44791
**DYSPROSIUM ISOTOPES Dy-163**
gyromagnetic ratios ,(E/T), 20: 44791
**DYSPROSIUM ISOTOPES Dy-164**
energy levels of, vibrational, (E/T), 20: 44797
**DYSPROSIUM OXIDES**
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
**DYSPROSIUM PERRHENATES**
preparation and properties of, 20: 43217
**DYSPROSIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219
**DYSPROSIUM SYSTEMS**
Dy–graphite, preparation and properties of intercalation compounds in, (E), 20: 44999

**E**

**ECOLOGY**
effects of Project Sedan explosions on lizard, 20: 42732
element and energy transfer in Northeast Pacific Ocean, 20: 42731(R) (RLO-1751-2)
freshwater, dynamic processes involved in cesium-137 uptake in fish, 20: 43512(R) (ANL-7136, pp 315-27)
radiation effects on tropical rain forest, 20: 42853(R) (ORO-3299-1)
seasonal variations of zooplankton in Ligurian Sea, 20: 42734
survey of environmental radioactivity in West Germany, 20: 43626
**EGG YOLKS**
cesium-137 content in chicken, 20: 42735
**EGGS**
cesium-137 content in albumen and yolks of chicken, 20: 42735
radiation effects on development of fertilized frog, uv, 20: 42839(R) (ANL-7136, pp 154-61)
radiation effects on development of *Ascaridia galli*, x, 20: 42968
**ELBE RIVER**
radioactivity in, 1961 to 1966, 20: 45225
**ELECTRIC ARCS**
plasma density measurement in hollow-cathode, 20: 44864 (ORNL-4010)
plasma production in, jet properties of, 20: 44925
**ELECTRIC CHARGES**
motion in conducting pipes, electric and magnetic fields from pulsed, (T), 20: 44052
**ELECTRIC CONDENSERS**
design of 625-kJ battery, for magnetic field production, 20: 43457
feasibility study of high-temperature, 20: 43815(R) (NASA-CR-54356)
performance of 625-kJ battery, for magnetic field production, 20: 43458
use of capacitor bank in magnetic flux compression by imploding foils, (E), 20: 44031
**ELECTRIC CONDUCTIVITY**
radiation effects on, in oat coleoptile and peach fruit tissues, 20: 42815
radiation effects on, in rat muscle tissues, gamma, 20: 42929
use in studies of zirconium deformation recovery, 20: 43959
**ELECTRIC CONTROL SYSTEMS**
design use with laboratory equipment, 20: 42841(R) (ANL-7136, pp 266-89)
**ELECTRIC DISCHARGE**
breakdown of electrodeless ring, 20: 44860 (JUL-352-PP)
dynamics of argon gas laser, 20: 44410
ion-wave propagation in gas, at frequencies above ion plasma frequency, 20: 44930
plasma properties in pulsed, spectra for, 20: 44959
plasma stability and oscillations, magnetic field effects on, (E), 20: 44917
torch interactions in pulse, properties of supersonic, 20: 44962
**ELECTRIC FIELDS**
amplitude and phase of wake, from pulsed charges moving in conducting pipes, (T), 20: 44052
atom ionization in varying, (T), 20: 44151
charged particle motion in Coulomb, bremsstrahlung emission from, (T), 20: 44039
measurement in weakly turbulent plasmas, spatial and temporal correlations for, 20: 44924(T)
**ELECTRIC INSULATORS**
performance in high voltage apparatus in vacuum, 20: 44043 (RHEL-R-124)
radiation effects on, for SNAP 8, 20: 45194 (NAA-SR-11924)
radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
use of plastics as, 20: 43471
**ELECTRIC POTENTIAL**
measurement of pulsed kilovolt, delivered to high power r-f tubes, 20: 43634 (SLAC-PUB-199)
**ELECTRIC POWER**
generation of, conference on instrumentation for, 20: 43665
generation of, cost studies for 300 to 1500 Mw fossil-fuel plants for, 20: 45242 (TID-22978(Rev.))
**ELECTRIC PROBES**

current characteristics in low-density plasma stream, (T), 20: 44919
design with guard rings and thermocouples for plasma studies, 20: 44862 (NASA-TM-X-1294)
electric conductivity in isotropic plasmas, measurement of, 20: 44927
performance of, electronic differentiation of characteristic curves for, 20: 43686
plasma diagnostics with Langmuir-type, (E), 20: 44878
use of free-molecule Langmuir, in low-density argon plasma diagnostics, (E), 20: 44876
use of negative bias, in plasma study, (E), 20: 44909

**ELECTRICITY**
generation using thermionic converters, 20: 44168
production by nuclear plants, model analysis of, 20: 45128

**ELECTRODEPOSITION**
determination of uranium in biological materials by radiochemical, 20: 43405

**ELECTROLYTIC CELLS**
design of, for use in deposition of radioisotopes, 20: 43395

**ELECTROLYTIC SEPARATION PROCESSES**
use of dialysis, for strontium-90 decontamination of milk, 20: 43537

**ELECTROMAGNETIC FIELDS**
book: *The Quantum Equation and the Theory of Fields,* 20: 44401
charged-particle motion in, (T), 20: 44985(T)
effects on covariant wave equation of spin-one particles, 20: 44480 (IS-T-95)
interactions with mesons, energy-momentum tensor for, 20: 44389
plasma acceleration by, (E), 20: 44891
spinor fields for external, properties of, 20: 44388

**ELECTROMAGNETIC LENSES**
design of aperture-corrected quadrupole, 20: 44047
fields of, functions for Glaser and step, 20: 44049
use of quadrupole, for focusing and steering particle beams, 20: 44065

**ELECTROMAGNETIC WAVES**
coupling of acoustic waves and, across plasma-air boundary, (T), 20: 44908
interactions in magnetoplasma, nonlinear, (T), 20: 44954
interactions with spin waves in antiferromagnetic metals, coupling of, 20: 43982
propagation in cylindrically stratified axially magnetized plasma, (T), 20: 44951
propagation in magnetoplasma with acoustic waves, (T), 20: 44899
propagation in metals of helicon, (T), 20: 44993 (NYO-2150-19)
propagation in semiconductors, nonlinear theory of, 20: 44966
propagation in warm magnetoplasma, ringing phenomena in, 20: 44944
reflection and transmission by plasma layers, (T), 20: 44897
scattering of circularly polarized, incoherent, 20: 44398
scattering of two plane, solution in nonlinear scalar field theory for, 20: 44399

**ELECTRON BEAMS**
collimator for, effects on energy spectrum, 20: 43040
color centers in lithium and sodium fluorides induced by, zero-phonon lines of, (E), 20: 45035
cyclotron instability of, theory of two-stream, 20: 44894
dosimetry of, in dogs using lithium fluoride thermoluminescent detectors, 20: 43747
effects (RBE) of 35 Mev, in mice as function of tissue depth in lucite phantoms, 20: 42974
effects of 15- and 50-Mev, on crystal structure of germanium, (E), 20: 45009
effects on bronchial carcinomas, lethal, 20: 43018
effects on dry mass of Ehrlich ascites tumors, 20: 42817
effects on germanium and silicon single crystals, 20: 44998
effects on HeLa cell colonies, 20: 42963
interactions of relativistic, transverse resistive-wall stability for, (T), 20: 44058
transmission through plasma, deceleration and thermalization in, (T), 20: 44882
use for therapy of skin metastases, 20: 43039
use for therapy, radiation protection of patient during, 20: 43012 (BMwF-FBK-66-03)
wave interactions with plasma in magnetic field, 20: 44853 (AD-630040)

**ELECTRON-DIFFRACTION ANALYSIS**
use for determination of contents of ternary systems, 20: 43120

**ELECTRON MICROSCOPY**
of irradiated retinal cells of rabbits, 20: 42958
sample preparation of microorganisms for, 20: 42701(R) (ANL-7136, pp 205-30)
use for particle track discrimination in nuclear emulsions, 20: 43731
use in determining DNA structure in coliphage, 20: 42715(R) (UCRL-16246, pp 145-55)

**ELECTRON MULTIPLIER TUBES**
gain of, ion beam effects on, (E), 20: 43659

**ELECTRON PAIRS**
production and annihilation of, 20: 44282

**ELECTRON SOURCES**
design of Pierce-electrode-type, 20: 44922

**ELECTRON TUBES**
performance of dismountable pulse, for nanosecond techniques, 20: 43644

**ELECTRONIC EQUIPMENT**
development of, for nuclear detector data processing, 20: 43645
performance of tunnel-diode monostable circuits, 20: 43649
radiation effects on monolithic microelectronic, 20: 43753(R) (AD-636773)

**ELECTRONS**
absorption coefficients of, in magnesium oxide crystals, 20: 45014
angular distributions and energy spectra of auroral-zone, (E), 20: 44441
binding energy, energy levels, excitation energy, and oscillator strength of hydrated, 20: 43322
book: *Electron and Ion Processes in Solids,* 20: 43265
bremsstrahlung production by, at high energies, (E), 20: 44190(T)
capture in hydrogen ion-helium reactions at 4.5 to 60 kev, (E), 20: 44138
content in ionosphere at 100 to 200 km, (T), 20: 44462
content in ionosphere at temperature latitudes during declining phase of sunspot cycle, (E/T), 20: 44449
content in mesosphere and stratosphere, (E), 20: 44463
crosslinking of liquid and solid trans-1,4-polyisoprene, effects of physical state on, 20: 43326
cyclotron radiation of relativistic, negative re-absorption of, 20: 44040
density decrease in F region of ionosphere during passage of powered rocket, (E), 20: 44459
density distributions in daytime F-layer, calculation of, 20: 44467
density enhancement in ionospheric F2 region, night-time abnormal, 20: 44473
density in ionospheric F2 region, (T), 20: 44474
density in ionosphere, gyro-plasma probe measurement of, 20: 44476
density in ionospheric sporadic-E layers, correlation with magnetic field variations, (T), 20: 44468
density irregularities in ionosphere, diurnal variation of, (E), 20: 44450
detection of avalanches of, by charge imaging on insulating foils, (E), 20: 43743
diffraction channelling in crystals, 20: 44134
dispersion relation of plasmon in gas of, (T), 20: 44916
dosimetry of scattered, from therapeutic electron beams, 20: 43012 (BMwF-FBK-66-03)
dosimetry of, from high-energy beam, 20: 43040
effects on addition of formamide to olefins, 20: 43347
effects on conjugated dienes, ESR spectra of free radicals from, 20: 43325
effects on copper and silver at cryotemperatures, recovery rates of, 20: 44022
effects on crystal structure of metals, recovery from, (E/T), 20: 45040
effects on electric properties of MOS field-effect transistors, 20: 43752 (AD-635583)
effects on heptane at 77°K, 20: 43312
effects on hydrogen dissociation as function of energy, 20: 43288(R) (CALT-532-1)
effects on n-type silicon at energies below 300 kev, 20: 45001
effects on nitric acid and sodium nitrate, nitrate yields from, 20: 43321
effects on organic lacquer films, cross linking from, 20: 43353
effects on *p*-benzhydroquinone and phenol, 20: 4332
effects on polyethylene terephthalates, 20: 43378
effects on structure of silicon in solar cells, 20: 45018
effects on sulfur-containing compounds, EPR studies of, 20: 43330
effects on thermal cracking of gasoline, 20: 43336(T)
emission from copper-64 embedded in copper single crystals, 20: 45019
emission from liquid helium, potential barrier effects on, 20: 44556
emission of secondary, statistics of, 20: 44112(T) (ORNL-tr-1266)
energy in ionosphere, thermal conduction effects on, 20: 44430
energy loss to ionization in cesium iodide, Ne 102A scintillator, and argon-methane at 20 to 150 Mev, 20: 44232
energy losses in thin foils of beryllium and antimony at 28.5 Mev, 20: 45003
energy variation of, precipitating into atmosphere, (T), 20: 44474
excitation of molecular nitrogen by, cross section for vibrational, (T), 20: 44125
flux in auroral zone, anticorrelations with protons, (E), 20: 44442
flux in outer radiation belt during geomagnetic storms, temporal variation of low-energy, (E), 20: 44454
flux inside aurora, electron spectrometer for determining, 20: 43667 (AD-639694)
Green function for, pole singularities in, 20: 44397
interactions with phonons in indium, coupling from, 20: 44553
interactions with protons, radiative corrections for, 20: 44179
interactions with positrons, double bremsstrahlung production by, (T), 20: 44202
interactions with elementary particles, sum rules and Cabibbo-Radicati

relation for, 20: 44223
interactions with protons, radiative corrections to meson ($\pi$) production in, 20: 44225
interactions with photons at high energies, amplitude for backward Compton, (T), 20: 44234
interactions with protons, cross sections for elastic, (E), 20: 44253
interactions with deuterons, CP violation in elastic, 20: 44279
interactions with intense laser field, nonrelativistic quantum theory for, 20: 44486
ionization cross sections of ions, impact, (T), 20: 44871(T) (CONF-660332-1)
motion in channels in cylindrical dielectric rods, Vavilov-Cherenkov radiation from, 20: 44273
motion in matter with randomly distributed impurities or positive charges, (T), 20: 44393
motion of geomagnetically trapped, effect of superimposed electric field on, (T), 20: 44434
neutron scattering by metallic, cross sections for epithermal, (T), 20: 44135
pair correlation energies for atomic and molecular hydrogen, 20: 44132
precipitation in auroral zone, microbursts of, 20: 44453
production by primary cosmic protons in atmosphere, 20: 44156
production in lithium-compensated silicon at 77°K, temperature dependence of energy for, (E), 20: 45028
reactions (e,ep) with carbon at 0.2 and 0.5 Bev, differential cross sections for, (T), 20: 44740
reactions of solvated, with mono- and disubstituted benzenes, 20: 43318
reactions with atoms and ions, empirical formula for ionization cross sections for, (T), 20: 44110 (IPP-1-50)
reactions with gases, ionization cross sections and mass spectra for, (E), 20: 44122
reactions with Pt, Au, Pd, Ag, Al, and Ti foils at 18 Mev, anomalous secondary electron emission from, 20: 44117
reactions with silver and aluminum foils of grazing-incidence, transition radiation from, 20: 44111 (ORNL-TM-1571)
reactions with single crystals of silicon at 15 Mev, coherent bremsstrahlung production in, (E), 20: 45020
scattering at 3.2 to 14.1 Mev on Al, Cu, Ag, and Au, backscattering from, (E), 20: 44115
scattering by atoms at low and high energies, calculations for, 20: 44108(R) (AD-630172)
scattering by bismuth and lead at 52.9 Mev, cross sections for, (E), 20: 44771
scattering by light nuclei, sum rule for inelastic, (T), 20: 44636 (INP-479/PL)
scattering by nuclei at high energies, phase shifts for elastic, (T), 20: 44675
scattering by nuclei, review of nuclear structure determination from inelastic, 20: 44679
scattering by nuclei, cross section for inelastic, 20: 44208
scattering by nuclei, solution of Dirac equation using Green functions, (T), 20: 44847
scattering by oxygen-16, inelastic, (E), 20: 44769
scattering by residual gas, Mott evaluation of, 20: 44114
scattering by titanium-46 and titanium-50 at 29 and 58 Mev, nuclear charge distributions from, (E), 20: 44789
scattering from Au, Ag, and Cu at 3.2 to 14.1 Mev, backscattering energy distributions from, (E), 20: 44116
spectra of trapped, in frozen aqueous solutions of sodium hydroxide, sulfuric acid, and water, EPR, 20: 43290 (COO-1528-7)
theory for spinning, classical models from WKB solutions to Dirac and Pauli equations for, 20: 44268
thermodynamic properties of plasma of, (T), 20: 44955
transport of, ultraviolet radiation effects in *Mycobacterium phlei*, 20: 42810
use in radiopreservation of foods, 20: 43794

**ELECTROPHORESIS**
behavior of rat erythrocytes subjected to, effects of bacterial $\alpha$-amylase on, 20: 42714 (UCRL-16246, pp 119-25)
thorium purification by, 20: 43820
use for separation of lipoprotein fractions, 20: 42717(R) (UCRL-16246, pp 176-85)
use in frog serum protein studies following gamma radiation, 20: 42787

**ELECTROSTATIC GENERATORS**
design for ion acceleration, 20: 44068(P)

**ELEMENT ONE HUNDRED AND FOUR**
chemical properties, 20: 43192

**ELEMENTARY PARTICLES**
book: *Antimatter*, 20: 44282
book: *Introduction to Strong Interactions*, 20: 44400
book: *Nuclear Chemistry*, 20: 43056(T) (JPRS-36943)
charge and magnetic moment for, relation between energy-momentum tensor and, 20: 44391
charge of ur-hadrons, 20: 44355
charge-current commutator for, meson ($\rho$) dominance contradiction for, (T), 20: 44360
composite structure of, criteria for, 20: 44345
decays of, SU(3) theory of strong, 20: 44331
detection of relativistic, 20: 43738
electromagnetic vertex for arbitrary-spin, inelastic, 20: 44208
electroproduction of, sum rules and Cabibbo-Radicati relation for, 20: 44223
energy levels of, individual-particle approximation of higher-excited, (T), 20: 44220
energy-momentum tensor for, relation to charge and magnetic moment, 20: 44391
excitation states of, perturbation calculation of rotational, 20: 44219
existence of zero-mass, under violation of strong-interaction symmetry, 20: 44395
field theory for free massive spin-2, energy dependence on canonical variables in, 20: 44295
form factors for arbitrary-spin, electromagnetic, 20: 44327
interactions at high energies, real amplitude for elastic, (T), 20: 44384
interactions at high energies and fixed momentum transfer, double logarithmic asymptotics for two-body, 20: 44361
interactions at high energies, sum rules for, 20: 44366
interactions of arbitrary-spin massless, self-consistency in, 20: 44372
interactions of hadrons, structural model for, (T), 20: 44213
interactions of quarks, magnetic monopole selection principle for, (T), 20: 44261
interactions of scalar, Bethe-Salpeter equation for, 20: 44335
interactions of spin-½, without intrinsic magnetic moment, (T), 20: 44369
interactions of systems of, Pauli equation for one-particle density matrix for, 20: 44181
interactions of, absorption and scattering effects in peripheral, 20: 44348
interactions of, analytical properties of scattering amplitude for g $\phi^4$ lagrangian, 20: 44396
interactions of, analytic expression for class of Green's functions for, 20: 44368
interactions of, calculation of Feynman diagrams for, 20: 44294
interactions of, covariant quantum field theory for matrix elements of electromagnetic and weak, 20: 44349
interactions of, canonical ensemble formalism for multiple production from, 20: 44373
interactions of, C$\gamma$ invariance of hadrons in strong, 20: 44367
interactions of, isospin properties of electromagnetic, (T), 20: 44371
interactions of, magnetic monopole and two-photon theory of C violation in electromagnetic, 20: 44364
interactions of, model for meson-quark, 20: 44365
interactions of, nonuniqueness of N/D solutions for singular potentials for, 20: 44347
interactions of, particle grouping and selection rules for strong and weak, 20: 44379
interactions of, phase shifts in stochastic fields for, (T), 20: 44393
interactions of, Regge-pole model for cross sections of strong, (T), 20: 44206
interactions of, renormalizable field-theoretical model for weak, 20: 44333
interactions of, spectral representations for nonrelativistic and relativistic Bethe-Salpeter equation for, 20: 44298
interactions of, $SU_6$ algebra for strong, 20: 44336
interactions of, two-meson solution of charged scalar static model for, 20: 44316
interactions of, W-spin constraints on C-violating electromagnetic, 20: 44198
interactions with nucleons, particle production from inelastic, (T), 20: 44180
interactions with mesons ($\pi$), scattering lengths for, (T), 20: 44256
mass in bound and free states, Bethe-Salpeter equation for effective, 20: 44218
mass of, group theory for formulas for, 20: 44378
mass splitting in de Sitter group, intrinsic, 20: 44338
model for quarks, quasar energies from, 20: 44094
model for, nonrelativistic quark, 20: 44254
motion of, radiationless condition and renormalization for space-time trajectory for, 20: 44380
motion of, unified approach for equation of, 20: 44382
photodisintegration of, inelastic electromagnetic vertex of photon from, 20: 44208
production and decay of, geometrical correlations between, 20: 44187
quarks in cosmology, 20: 44089
spin and statistics of, S-matrix theory for, 20: 44332
sum rules for, from current commutation relations, 20: 44362
symmetry for hadrons, oscillator-like representations of U(N,N) algebras for, 20: 44387

symmetry for hadrons, oscillator-like representations of U(2,2) algebra in spin basis, 20: 44288
symmetry for, Clebsch-Gordon coefficient for product $35 \otimes 35$ in SU(6), 20: 44285
symmetry for, Clebsch-Gordon series in, 20: 44322
symmetry for, dynamical models and mass formulas for resonance multiplets in, 20: 44370
symmetry for, fundamental triplet degrees of freedom in SU(3), 20: 44376
symmetry for, review of breaking of CPT, 20: 44296
symmetry for, spin perturbation theory for boson or fermion operators for group generators in, 20: 44304
symmetry group for, SU(6,6), 20: 44302
symmetry groups for, contraction theorem for pseudo-orthogonal, 20: 44346
symmetry groups for, six-dimensional form of Dirac's matrix algebra for, 20: 44387
symmetry groups for, $O_4$ dynamical, 20: 44290
symmetry groups for, dynamical SU(3), 20: 44291
symmetry theory for, chiral SU(3) × SU(3) algebra and SU(6), 20: 44323
theory for composite, multiple field relations in, 20: 44363
theory for, canonical quantization in, 20: 44297
wave equations for, unified, 20: 44383

**ELEMENTS**
analysis for iron using 1,10-phenanthroline, colorimetric, 20: 43067(R) (IDO-14679, pp 6-46)
determination as impurities in uranium(IV-VI) oxides, sensitivity limits for spectrographic, 20: 43079 (ORNL-TM-1590)
determination of light, by proton activation methods, 20: 43127
effects of trace, on protein fractions in blood serum of irradiated rabbits, 20: 42870
gamma coherent scattering at small angles, incoherent component in, (E/T), 20: 44147
gamma reactions (γ,n), (E), 20: 44681

**EMBRYOS**
allometric relation between radiosulfate metabolism and weight changes in mouse, 20: 42765
growth of, dynamics of, 20: 42840(R) (ANL-7136, pp 164-90)
lens differentiation in early chick, 20: 42839(R) (ANL-7136, pp 154-61)
protein synthesis in frog, tracer study, 20: 42839(R) (ANL-7136, pp 154-61)
radiation effects on respiration in developing salmon, γ, 20: 42820

**EMISSIVITY**
measurement at high temperature, equipment for, 20: 43816(R) (PWA-2877)

**EMULSIONS**
radioinduced polymerization of vinyl monomers in, gamma, 20: 43374
use of iodinated, for renal angiography, 20: 43024

**ENDOCRINE GLANDS**
radiation effects on phospholipid metabolism, gamma, 20: 42796

**ENDOXAN**
effects on leukocyte counts in x-irradiated rats, 20: 42965

**ENVIRONMENT**
radiological monitoring of, in emergency situations, manual on, 20: 43589 (STI-PUB-118)

**ENZYMES**
activity of, in tissues, tracer studies of, 20: 43118
effects of deuterium oxide on beef heart aconitase and pancreatic lipase, 20: 42738(R) (ANL-7136, pp 255-65)
radiation effects on activity of hexokinase, in rat bone marrow, x, 20: 42788
radiation effects on, comparison of alpha and gamma, 20: 42816
radiation effects on activity of, involved in glucose metabolism, 20: 42856 (TID-23213)
radiation effects on glycolytic, in bone marrow, ionizing, 20: 42822
radiation effects on activity in rat blood of, whole-body x, 20: 42955
radiation inactivation of, in fruits and vegetables, 20: 43781
radiosensitivity of crude and purified pectic, 20: 43785
reactions of, in biosynthesis of methionine, propionate, erythritol, proteins, and sterols, 20: 42737(R) (ANL-7136, pp 231-42)

**EPIDEMIOLOGY**
of diseases likely to occur in postattack environment, 20: 43588 (RM-5090-TAB)

**EPITHELIUM**
radioinduced carcinogenesis in rat mammary, relation of DNA synthesis to x, 20: 42840(R) (ANL-7136, pp 164-90)
radiosensitivity of mouse spermatogenic, γ and x, 20: 42942

**EQUIPMENT AND PROCEDURES**
design and development of, for Transuranium Processing Plant, 20: 43425 (ORNL-P-2406)
design and development of fluid-bed equipment for enriched uranium processing, 20: 43202
development of, for using radioisotopes in Canada, 20: 43763
for ventilating radioisotope laboratories, 20: 43593(T) (AEC-tr-6642)
thyroid radioiodine uptake measurements calibration, 20: 43031

**ERBIUM**
determination of, effects of metal ions on spectrophotometric, 20: 43100
ionization potentials of, electron-impact method for measuring, 20: 43235
spectra in gadolinium trichloride, magnetic effects on, 20: 43177 (NP-16303)
spectra of four lowest configurations of triply ionized, in free or vapor state, 20: 43175 (NP-16301)

**ERBIUM ALLOYS**
Al–Er, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Er, crystal structure of intermetallic compound, 20: 43920
Er–Mn, crystal structure of intermetallic compound, 20: 43918

**ERBIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

**ERBIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with antipyrine-salicylates, benzene solvent extraction studies on, 20: 43256
with glycolic and lactic acids, thermodynamic properties of, 20: 43215

**ERBIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218

**ERBIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
preparation of cerium oxide single crystals containing, (E), 20: 43818

**ERBIUM ISOTOPES Er-166**
separation from neutron-deficient thulium-165, 20: 43067(R) (IDO-14679, pp 6-46)

**ERBIUM ISOTOPES Er-167**
gyromagnetic ratios, (E/T), 20: 44791

**ERBIUM ISOTOPES Er-170**
separation of thulium-172 from, by cation exchange chromatography, 20: 43067(R) (IDO-14679, pp 6-46)

**ERBIUM OXIDES**
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364

**ERBIUM PERRHENATES**
preparation and properties of, 20: 43217

**ERBIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219

**ERBIUM SYSTEMS**
Er–graphite, preparation and properties of intercalation compounds in, (E), 20: 44999

**ERYTHRITOL**
metabolism in bacteria, enzyme reactions for, 20: 42737(R) (ANL-7136, pp 231-42)
radiolysis of, correlation of structural unit with G values of products from gamma, 20: 43296

**ERYTHROCYTES**
distribution of cesium and rubidium in human, 20: 42778
effects of incubation with bacterial α-amylase on rat, 20: 42714 (UCRL-16246, pp 119-25)
hemaglobin characteristics of, from abnormal fetus and young and old normal, 20: 43272(R) (RLO-581-10, pp 5-32)
radiation effects on mitosis in erythroblasts of man, chronic low-level, 20: 42884
radiation effects on permeability of rat, whole-body x, 20: 42955
radiation effects on hemoglobin content and metabolism in rat, whole-body lethal x, 20: 42955
use of rubidium-86 tagged, in coronary circulation study, 20: 42749

**ERYTHROPOIESIS**
effects of erythropoietin administration on mouse, effects of injection time on, 20: 42713(R) (UCRL-16246, pp 107-18)
occurrence in polycythemia patients, iron-59 tracer study of, 20: 43015(R) (UCRL-16246, pp 1-18)
radiation dose effects in rats, x, 20: 42957
radiation effects on, in man, beta and gamma, 20: 42908
radiosensitivity of, 20: 42845 (CONF-660543-1)

**ERYTHROPOIETIN**
effects on stem-cell populations in hypertransfused mice, effects of injection time on, 20: 42713(R) (UCRL-16246, pp 107-18)

**ESCHERICHIA COLI**
effects of caffeine on, genetic, 20: 42838(R) (ANL-7136, pp 140-54)
effects of radiation from space flight on, 20: 42912
effects of space flight on phage induction and viability in, treated with β-mercaptopropylamine, 20: 42911
genetic recombination in, role of DNA synthesis in, 20: 42838(R) (ANL-7136, pp 140-54)

- horseradish peroxidase effects on t-RNA activity of, 20: 42809
- mutation formation in, role of DNA in, 20: 42838(R) (ANL-7136, pp 140-54)
- mutations induced by acridines, reaction mechanisms for, 20: 42838(R) (ANL-7136, pp 140-54)
- photoreversal of uv-induced dark repairable blockage of DNA synthesis and mutations in, 20: 42812
- population growth of, mathematical model for, 20: 42838(R) (ANL-7136, pp 140-54)
- radiation effects on phage induction and viability in, during space flight, cosmic, 20: 42910
- radioinduced mutations in, mechanisms of uv, 20: 42918
- radioinduced RNA breakdown in, x, 20: 42814
- radiosensitivity of, effects of acridine orange and oxygen on uv, 20: 42838(R) (ANL-7136, pp 140-54)
- thymine utilization in, effects of ribosides on, 20: 42716(R) (UCRL-16246, pp 164-7)
- ultraviolet radiation effects on t-RNA activity of, 20: 42809

**ESOPHAGUS**
- radiation dosimetry in dog and human, using lithium fluoride thermoluminescent dosimeters, γ and x, 20: 43747
- transit time of ceramic spheres containing manganese-54 or uranium carbide particles in, of animals and man, 20: 42740 (LA-DC-7764)

**ESTERASES**
- radiation effects on activity in rats, x, 20: 42824
- radiation effects on activity of acetylcholine, in rats, 20: 42964

**ETHANE**
- ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122
- production in argon-sensitized radiolysis by liquid propane, 20: 43368
- yields in radiolysis of ethyltoluene isomers, effects of dose, scavenger, and temperature on, 20: 43359

**ETHANE, BROMO-**
- effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
- effects on gamma-induced polymerization of styrene at −78°C, 20: 43308
- radiolysis of, use of charged plates in collecting products from neutron, 20: 43367
- yields from gamma-induced addition reactions of ethylene and hydrobromic acid, 20: 43298
- benzene–bromoethane, radiation effects of (n,γ) and (n,2n) reactions in, 20: 43334

**ETHANE, DIMETHOXY-**
- acetonitrile–methanol, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224

**ETHANE, HEXAFLUORO-**
- effects on hydrogen yields in gamma radiolysis of cyclohexane and hexane, 20: 43316

**ETHANE, IODO-**
- radiolysis of, use of charged plates in collecting products from neutron, 20: 43367

**ETHANETHIOL**
- radiolysis of liquid, yields from x, 20: 43320

**ETHANETHIOL, 2-AMINO-**
- effects on bactericidal activity of irradiated blood serum of rats, 20: 43003
- effects on content of histamine and histamine-like substances in guinea pig blood, 20: 42982
- effects on radioinduced changes in ESR spectra of bacteria, 20: 42802
- protective effects against alpha and gamma radiation of enzymes, 20: 42816
- protective effects against radiation injuries in mice, 20: 42983
- radioprotective action in guinea pigs, mechanism for, 20: 42982
- radioprotective effects on mice and rats, reaction mechanisms for, 20: 42998(R) (EUR-2992.f)
- radiosensitivity effects on mice from intravenous or oral injection in gum arabic solution, x, 20: 42997(R) (ANL-7136, pp 191-204)
- radiosensitivity effects on guinea pig skin, 20: 42990

**ETHANOL**
- effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
- effects on gamma radiation effects on biphenyl, spectral studies on, 20: 43314
- metabolism in mice, effects of catalase activity on, 20: 42837(R) (ANL-7136, pp 124-40)
- solvent properties for neptunium, 20: 43396
- solvent properties for fructose, glucose, and sucrose, 20: 43402
- acetonitrile–ethanol, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
- acetonitrile–methanol, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
- ethanol–nitrates, radiolysis of, yields of primary hydrogen during gamma, 20: 43351

**ETHER, ISOBUTYL VINYL**
- radioinduced polymerization with styrene, effects of ammonia and diethyl ether on, 20: 43338

**ETHERS**
- vinyl, radioinduced polymerization of, 20: 43379(P)
- yields in irradiation of hydrocarbon and carbon dioxide mixtures, 20: 43333

**ETHYL ACETATE**
- properties as chromatographic developer, 20: 43406

**ETHYL ETHER**
- effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
- effects of radioinduced polymerization of styrene, α-methylstyrene, and isobutyl vinyl ether, 20: 43338
- acetone–ethyl ether, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
- ethyl ether–methanol, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452

**ETHYLAMINE, 2,2′-DITHIOBIS-**
- effect on hematopoietic cells of irradiated mice, 20: 42938
- effects on acceleration tolerance of mice and guinea pigs, 20: 43004
- formation during electron irradiation of primitive Earth atmosphere, tracer studies of, 20: 42726
- protective effects against γ and protons in mice, 20: 43002
- radioprotective effects on mice and rats, reaction mechanisms for, 20: 42998(R) (EUR-2992.f)
- radioprotective effects combined with apilac in mice, rabbits, and rats, 20: 43009

**ETHYLENE**
- effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
- hydrogenation of deuterated and normal substituted, mechanism of metal-catalyzed, 20: 43279
- ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122
- isomerization of deuterated, by benzene photosensitization, 20: 43197
- labeling with deuterium, isotopic exchange, 20: 43409(P)
- radiation effects on reactions with hydrobromic acid in liquid phase at −79°C, 20: 43298
- radioinduced polymerization of, kinetics of low-dose, 20: 43327
- spectra at 50 ev, energy losses in electron-impact, 20: 43288(R) (CALT-532-1)
- yields in radiolysis of ethyltoluene isomers, effects of dose, scavenger, and temperature on, 20: 43359

**ETHYLENE, CHLORO-**
- thermal stability of membraneous filters of, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)

**ETHYLENE, CHLORO- POLYMERS**
- decontamination of, using sulfuric acid-activated titanium dioxide, 20: 43385
- radioinduced graft polymerization with styrene, gamma, 20: 43372

**ETHYLENE, DICHLORO-**
- radioinduced polymerization of emulsions of, gamma, 20: 43374

**ETHYLENE, DIFLUORO- POLYMERS**
- radioinduced crosslinking of, gamma, 20: 43371

**ETHYLENE GLYCOL POLYMERS**
- radioinduced crosslinking of, in aqueous solutions, gamma, 20: 43375

**ETHYLENE POLYMERS**
- gamma radiation effects on, induced electric conductivity, 20: 44997
- neutron scattering by, differential inelastic cross sections for epithermal, (E), 20: 44576 (CONF-660303, pp 122-33)
- proton polarization in radiation damaged, by solid effect, 20: 45024
- radiation effects on surface electrification of, gamma, 20: 43337
- alkyl acrylate polymers–polyethylene, radiation effects on, 20: 43376

**ETHYLENE, TETRAFLUORO- POLYMERS**
- thermal stability of fibers of, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)
- glass–polytetrafluoroethylene, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)

**ETHYLENIMINE**
- effects combined with x radiation on mutagenesis synergistic action, 20: 42919

**EUGLENA**
- radiation effects on, γ, 20: 42906

**EUROPIUM**
- content in Gulf of Mexico surface water, 20: 43087(R) (TID-23295, Sect.4)
- ionization potentials of, electron-impact method for measuring, 20: 43235
- reactions with chromium and vanadium in aqueous perchloric acid solutions, spectrophotometric studies on kinetics of, 20: 43228
- separation from aqueous solutions by solvent extraction using TTA and 8-quinolinol, 20: 43432
- separation from aqueous solutions by solvent extraction using di-acidic

- phosphorus-based compounds, 20: 43445
- separation from aqueous solutions by solvent extraction using dinonylnaphthalenesulfonic acid and its sodium salt, 20: 43447
- separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)
- separation of, from cesium and zirconium by paper electrophoresis, 20: 43451
- sorption by bismuth iodates, 20: 43448

**EUROPIUM ALLOYS**
- Al–Eu, properties of intermetallic compounds in, tabulation of, 20: 43972

**EUROPIUM CHLORIDES**
- reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

**EUROPIUM COMPLEXES**
- with glycolic and lactic acids, thermodynamic properties of, 20: 43215

**EUROPIUM HYDROXIDES**
- structure of sols of, electron diffraction and microscopy studies on, 20: 43181 (ORNL-P-2439)

**EUROPIUM IONS**
- effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
- electromigration of trivalent, in sodium hexametaphosphate during paper electrophoresis, 20: 43451
- fluorescence of trivalent, in sodium tungstate solution, 20: 43211
- fluorescence of trivalent, in potassium oxalate solution, 20: 43212
- hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221

**EUROPIUM ISOTOPES Eu-144**
- separation of neutron-deficient, from samarium-144, 20: 43067(R) (IDO-14679, pp 6-46)

**EUROPIUM ISOTOPES Eu-145**
- beta decay of, samarium-145 energy levels from, (E), 20: 44845
- gamma spectra, 20: 44634(R) (IDO-17188)

**EUROPIUM ISOTOPES Eu-146**
- gamma spectra, 20: 44634(R) (IDO-17188)

**EUROPIUM ISOTOPES Eu-147**
- gamma spectra, 20: 44634(R) (IDO-17188)

**EUROPIUM ISOTOPES Eu-149**
- decay of, gamma-ray and conversion-electron spectra from, 20: 45046(R) (IDO-17192)
- gamma spectra, 20: 44634(R) (IDO-17188)

**EUROPIUM ISOTOPES Eu-150**
- gamma spectra, 20: 44634(R) (IDO-17188)

**EUROPIUM ISOTOPES Eu-151**
- use for prepoison reactivity control in SNAP reactors, 20: 45193 (CONF-660303, pp 204-9)

**EUROPIUM ISOTOPES Eu-152**
- determination in neutron-irradiated clays and soils, 20: 43607
- gamma spectra, 20: 44634(R) (IDO-17188)
- incorporation in tetrahydrated ammonium cerium sulfates, mixed crystal formation in, 20: 43252

**EUROPIUM ISOTOPES Eu-153**
- gyromagnetic ratios, (E/T), 20: 44791

**EUROPIUM ISOTOPES Eu-154**
- determination in neutron-irradiated clays and soils, 20: 43607
- gamma spectra, 20: 44634(R) (IDO-17188)
- incorporation in tetrahydrated ammonium cerium sulfates, mixed crystal formation in, 20: 43252

**EUROPIUM ISOTOPES Eu-155**
- energy-level transitions from decay of samarium-155, 20: 44736
- gamma spectra, 20: 44634(R) (IDO-17188)

**EUROPIUM OXIDES**
- $Eu_2O_3$–$UO_2$, phase studies, 20: 43853 (GEAP-5008)
- $Eu_2O_3$–$UO_2$, sintering of, 20: 43853 (GEAP-5008)

**EUROPIUM PERRHENATES**
- preparation and properties of, 20: 43217

**EUROPIUM PHOSPHATES**
- crystal structure of, infrared spectral studies on, 20: 43219

**EUROPIUM SELENIDES**
- magnetic transitions in, below 3.8°K, 20: 44523

**EUROPIUM SULFATES**
- crystal structure of, infrared spectral studies on, 20: 43219

**EUTECTICS**
- superconducting properties of alloy, effects of structure on, (E), 20: 44514

**EVAPORATION**
- oxygen-18 enrichment in sea water by, 20: 43509

**EVOLUTION**
- radiation in, role of, 20: 42906

**EXCRETION**
- calculation of radiostrontium, in human urine and feces, 20: 42779
- interspecies comparisons in mammalian cesium and potassium, 20: 42768
- measurement of cesium-137, in cattle and sheep, 20: 42739(R) (COO-1339-3)
- radiation effects on mucoprotein, in rats, x, 20: 42960

**EXERCISE**
- effects of, on body content of potassium-40 and -42, 20: 42739(R) (COO-1339-3)

**EXPERIMENTAL BOILING WATER REACTOR**
- fuel elements for, radiation effects on prototype, 20: 43812(R) (BNWL-269, pp 4.1-9)

**EXPERIMENTAL BREEDER REACTOR-II**
- development and operation of, 20: 45106(R) (ANL-7249)
- performance, 20: 45156

**EXPERIMENTAL GAS COOLED REACTOR**
- moderator geometry effects on irradiation-induced stresses in, graphite, 20: 44000 (ORNL-TM-1574)

**EXPLOSIONS**
- blast wave attenuation from nitromethane, effect of burial on, 20: 43461 (PNE-607F)
- use in aluminum and tungsten carbide preparation, 20: 43952

**EXPONENTIAL PILES**
- buckling measurements in enriched uranium heavy-water lattices, 20: 45084
- fuel for, fabrication of uranium-233-bearing, 20: 43844 (AAEC-TM-315)
- lattice parameter determination in, use of neutron absorbers for, 20: 45078 (MIT-2344-6)
- material buckling in, computer programs for, 20: 45073 (INR-659/IXA/RP)
- neutron lifetime in, proof of formula for Rossi-$\alpha$ method for measuring, 20: 45083
- reactivity transfer functions for SHE, measurement using pulsed neutrons, 20: 45082

**EYES**
- lens differentiation in early chick embryos, 20: 42839(R) (ANL-7136, pp 154-61)
- radiation effects on ultramicroscopic structure of retina, x, 20: 42958
- radioinduced exophthalmos of, following treatment of hyperthyroidism with radioiodine, 20: 42946
- radioinduced keratoconjunctivitis in cattle, uv, 20: 42863
- radiosensitivity of moth, $\beta$ and visible light, 20: 42852(R) (ORO-2903-28)
- tapetum of dog, morphology, incidence, and inheritance of, 20: 42837(R) (ANL-7136, pp 124-40)

## F

**FALLOUT**
- contamination of surface waters by, 20: 43598
- contamination of terrestrial environment by, 20: 43596
- content in plankton samples from Adriatic and Ligurian Seas, 20: 43536
- content in stratosphere produced by 1 MT nuclear detonation, 20: 43510 (RM-4989-TAB)
- detection of, from Chinese nuclear test of May 9, 1966, 20: 43577(R) (DPST-66-30-2)
- determination in rainwater in New Zealand from 1956 to 1959, 20: 43530
- diffusion through ocean water of soluble particles of, 20: 43541
- distribution in oceans worldwide, quantity evaluation, 20: 43517(T) (AEC-tr-6798, Paper 2)
- distribution in upper atmosphere over Sweden, 20: 43524
- distribution worldwide on ocean surfaces, 20: 43516(T) (AEC-tr-6798, Paper 1)
- effect on radium content of rain water, 20: 43529
- estimation by sampling vegetation in spring, 20: 43527
- fractionation of, from Chinese and Russian tests, 20: 43528
- hazards of, to populations during nuclear wars, 20: 43566 (AD-625251)
- levels of strontium-90 from, in United Kingdom, calculation of retention, 20: 42762
- measurement of simulated, in one-story and two-story structures, 20: 43496 (CEX-59.7B(Pt.1))
- monitoring in Illinois, 1965, 20: 43512(R) (ANL-7136, pp 315-27)
- monitoring in Japan, 1961–64, 20: 43615
- monitoring in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
- monitoring in New Zealand, 1965, 20: 43581(R) (NP-16245)
- monitoring in Switzerland, 1963, 20: 43519
- monitoring in the Black Sea, 1960–1964, 20: 45227
- monitoring in troposphere, development of balloon-borne scintillation detectors for, 20: 43512(R) (ANL-7136, pp 315-27)
- monitoring in water in Germany, 20: 43624
- monitoring of, in milk and water in Bombay, 1964 to 1965, 20: 43532
- protection from, review of aperture and ceiling-shine effects in, 20: 43526
- radiation doses to Alaskan Eskimos from cesium-137, 20: 43622
- shielding against, calculation of effectiveness of roof slab and structures, concrete, and iron for, 20: 43568 (AD-636787)

survey of radioactivity and radiation burden from, in West Germany, 20: 43626
**FAST REACTORS**
design of, effect of cross-section uncertainties on, 20: 45069 (CONF-660303, pp 809-20)
development of breeder, with steam cooling, 20: 45150
development of breeder, in United Kingdom, 20: 45172
development of 1000-Mw(e) breeder, 20: 45156
development of 250-Mw(e) prototype breeder, 20: 45158
development of, Karlsruhe project on, 20: 45148
fuel development for liquid metal breeder, 20: 45106(R) (ANL-7249)
fuel element cycle and breeding process for, 20: 45147
fuel processing for, by aqueous, pyrochemical, and volatility methods, economics of, 20: 43410 (ANL-7137)
fuel procurement and processing for German prototype breeder, economics of plutonium, 20: 45151
fuel rod fabrication for high-temperature, 20: 45100
neutron cross sections for calculations on power-breeder, accuracy of, 20: 45092
neutron spectra calculations, 20: 44580 (CONF-660303, pp 782-95)
reactivity coefficient measurements for sodium-cooled, 20: 45207(T) (EURFNR-76F)
reactivity coefficients of, calculation using perturbation theory, 20: 44582(NAA-SR-11963)
reactivity variations in sodium-cooled, group constants for, 20: 45075 (JAERI-1109)
safety of, effects of neutron cross section uncertainties on, 20: 45068 (CONF-660303, pp 430-53)
**FASTENERS**
design for beryllium alloy aerospace vehicle components, 20: 43859 (NASA-TM-X-53453(Vol.6))
**FATS**
content in rat liver after gamma irradiation, effects of dietary casein level, 20: 42864
labeling with iodine-131, 20: 43397
radiation effects on content in cotton pollen, gamma, 20: 42896
**FATTY ACID ESTERS**
effects of iodine-131-labeled ethiodol, on human lymph systems, 20: 42976
**FECES**
analysis for determining plutonium oxide inhalation, 20: 43630
iodine-131 measurement in, separately or simultaneously with plasma or urine, 20: 42782
passage of ceramic spheres containing manganese-54 or uranium carbide spheres in, of animals and man, 20: 42740 (LA-DC-7764)
radioactivity in human, following ingestion of iodine-131-labeled triolein, 20: 42782
**FELDSPARS**
age of estimation, by argon-potassium method, 20: 43503(R) (COO-689-60, App.A-3)
**FERMI FAST BREEDER REACTOR**
performance, 20: 45156
simulation of, analysis by analog computer, 20: 45168
**FERMIONS**
interactions with phonons in nuclei, (T), 20: 44678
**FERROIN**
use in determination of iron and vanadium, 20: 43144
**FERROMAGNETIC MATERIALS**
coupling of, using superconducting layers, 20: 45021
excitations in, Goldstone theory for, 20: 45042
**FERTILIZERS**
effects on chemical properties of recent volcanic ash soils, 20: 42850(R) (NYO-2043-130)
**FETUSES**
radiation dose to human, from strontium isotopes, 20: 43605
radiation effects on development of rats exposed as, x, 20: 42879
**FFAG ACCELERATORS**
development and operation of, problems in, 20: 44053
particle motion in, calculation of operating points and orbits of, 20: 44042 (MURA-719)
**FIELD THEORY**
book: *The Quantum Equation and the Theory of Fields*, 20: 44401
commutation relations from Schwinger action principle in, trilinear, 20: 44312
coordinate transformation in, theory of compensating fields for, 20: 44390
elementary particles in, energy dependence on canonical variables for massive spin-2, 20: 44295
energy-momentum tensor of interacting meson and electromagnetic fields in, 20: 44389
field equations in, analytic methods for solutions of local, 20: 44313
field equations in, conservation laws from, 20: 44320
formalism for relativistic double pole field, canonical, 20: 44292
Goldstone particles with conserved current in linear vector, 20: 44325
Goldstone theory and partially conserved currents in, 20: 44334
harmonic functions in, principle of maximum and minimum potential using, 20: 44300
Lorentz invariants in, properties of, 20: 44482
model for weak interactions, renormalizable, 20: 44333
operators in quantum, ordering theorems for, 20: 44311
operators in, quasi-analytical functionals and self-adjointness of, 20: 44329
quantization in space of constant torsion in, 20: 44308
quantization of relativistic, 20: 44284
quantum, local states in, 20: 44309
S-operator in quantum, Bogoliubov causality and dynamic postulate for, 20: 44317
scattering amplitude in, wave-packet derivation of, 20: 44318
scattering of two plane waves in nonlinear scalar, solution for, 20: 44399
spinor fields for external electromagnetic fields in, properties of, 20: 44388
spinor spaces in, Lorentz equivalence, unitary symmetry and spin unitary symmetry in, 20: 44315
spinor structure in, Clifford algebra formalism for 4-, 20: 44314
symmetries in, maximal groups and dynamic origin of internal, 20: 44339
symmetry transformation of Dirac field in, 20: 44385
vector fields in, stability of stationary states of nonlinear, 20: 44392
**FILMS**
deformation of anodic oxide, on aluminum, tantalum, and zirconium, 20: 43949
production in gas-metal reactions, computer program for calculating weight gains in, 20: 43898 (NAA-SR-Memo-11967)
**FILTER PAPERS**
use with conveyer belt system for air monitoring, 20: 43751(P)
**FILTERS**
analysis for beryllium-7, cadmium-109, lead-210, and polonium-210, radiochemical, 20: 43512(R) (ANL-7136, pp 315-27)
design and in-place testing of charcoal, for iodine retention at HFIR, 20: 43584 (ORNL-P-2411)
development and properties of U-Foam air, 20: 43570 (AEET-244)
development for alpha-gamma containment program for activity caves, 20: 43466 (DP-MS-66-16)
iodine retention on epoxy, 20: 43067(R) (IDO-14679, pp 6-46)
materials and performance specification requirements for particulate air, 20: 43583 (ORNL-P-2387)
use of slow sand, for radioactive decontamination of ground water recharge, 20: 43522
**FINLAND**
radioactivity of biota and humans of, 20: 43005
strontium-90 content in domestic and imported cereals in, 1963 and 1964, 20: 43006
**FIRES**
effects of forest, on weather, 20: 43510 (RM-4989-TAB)
**FISH**
analysis of Clinch and Tennessee Rivers, for radionuclide content, 20: 45216 (ORNL-3721)
calcium-45 metabolism in teleost, 20: 42750
cesium-137 content in Chicago, Ill., 1965, 20: 43512(R) (ANL-7136, pp 315-27)
cesium-137 uptake by freshwater, ecological factors affecting, 20: 43512(R) (ANL-7136, pp 315-27)
ecology of Eastern Mediterranean Sea, 20: 43508(R) (NP-16179)
radiation control of insect infestation in dried or smoked, 20: 43777
radiation control of insect infestation in dried or smoked, 20: 43778
radiation effects on respiration in developing salmon spawn and larvae, γ, 20: 42820
radiation effects on osmoregulation in salmon, x, 20: 42885
radiation effects on melanophores of Gambusia and Mollienisia, γ, 20: 42905
radiation effects on nutritional value and taste of dried or smoked, γ, 20: 43778
radiation effects on toxin production by *Clostridium botulinum*, type E, on, effects of polythene packaging and vacuum exposure on γ, 20: 43779
radiation effects on microbial populations on fillets of yellow perch, following refrigerated storage, gamma, 20: 43793
radiation processing of, 20: 43768
radiation processing of, effects on storage life, 20: 43775
radioactivity content of, from fallout in West Germany, 20: 43626
radioactivity in flesh of, recovered near Savannah River Plant, January to June 1966, 20: 43577(R) (DPST-66-30-2)
radioinduced formation of benzene, toluene, and sulfur compounds, 20: 42973
radiopreservation of haddock, gamma, 20: 43770
radiopreservation of, using gamma radiation, 20: 43774

- radiopreservation of, economic factors in developing countries, 20: 43775
- radiopreservation of fresh, pickled, salted, smoked, and cooked, effects on taste and storage life, gamma, 20: 43776

**FISSION**
- lifetimes in, use of underground nuclear explosions to study, 20: 43460 (ORNL-P-2389)
- fizzium–Pu–U, burnup testing of, 20: 45106(R) (ANL-7249)

**FISSION CHAMBERS**
- design and performance of, for reactor use, 20: 43716

**FISSION FRAGMENTS**
- effects on cadmium iodides and lead iodides, electron microscopy of, 20: 44023
- effects on crystal lattices, 20: 43987 (BNL-10569)
- effects on lead iodides, atomic displacements from, 20: 44024
- energy in neutron fission of uranium-235, dependence on mass ratio, (E), 20: 44673(T) (LA-tr-66-36)
- energy losses in argon, deuterium, helium, hydrogen, krypton, nitrogen, and xenon, (E), 20: 44685
- yields of, corrections to calculations of, (T), 20: 44819

**FISSION PRODUCTS**
- analysis for americium-241, extraction-radiometric, 20: 43072(R) (IDO-14679, pp 193-229)
- content in Black Sea, 1960–1964, 20: 45227
- determination in 10-day cooled nuclear fuel samples, method for, 20: 43067(R) (IDO-14679, pp 6-46)
- determination on carbon and stainless steel coupons, 20: 43072(R) (IDO-14679, pp 193-229)
- distribution between fuel and liquid metal coolant, test equipment for, 20: 43996 (LA-DC-7772)
- distribution in plutonium–uranium nitride fuels, 20: 43988(R) (BNWL-269, pp 2.1-11)
- distribution in plutonia–urania fuel pellets after high exposure, 20: 43988(R) (BNWL-269, pp 2.1-11)
- distribution in upper atmosphere over Sweden, 1962 to 1963, 20: 43524
- fixation in glass from concentrated solutions, process at Fontenay-aux-Roses, France for, 20: 45233
- fixation in glass, from concentrated waste solutions at Marcoule, France, 20: 45231
- formation of gaseous, effects on uranium, 20: 43995 (JAERI-4037)
- gas release from uranium dioxide irradiated at different doses, research program on, 20: 43992 (EURAEC-1667)
- localizing underground-explosion, use of olivines in, 20: 43464
- movement through food chain, 20: 43596
- separation from irradiated uranium dioxide and uranium hydride using phthalocyanine, 20: 43153
- separation of cerium from, by column partition chromatography, 20: 43419 (LA-DC-7869)
- separation of iodine and tellurium from, method for, 20: 43067(R) (IDO-14679, pp 6-46)
- separation of molybdenum, rhodium, and tellurium from other, 20: 44815
- separation of plutonium from, by isotope dilution for mass spectroscopy, 20: 43067(R) (IDO-14679, pp 6-46)
- separation of, from irradiated thorium and uranium oxides using molten sodium chloride, 20: 43454
- sorption on reactor surfaces in accidents, coating development for, 20: 45045(R) (BMI-X-10173)
- yields in spontaneous fission of uranium-238, 20: 44815

**FISSIONABLE MATERIAL**
- analysis for gamma activity, equipment and methods for, 20: 43074 (LA-DC-7831)
- neutron cross sections in the resonance region, (T), 20: 44624 (CONF-660303, pp 873-94)
- quality and quantity for AEC purchase of Umpire Qualification Program for determining, 20: 43070(R) (IDO-14679, pp 60-9)
- safeguards for use of, procedures for Yankee reactor, 20: 45108 (BNWL-119)

**FLAMES**
- temperature enhancement of, by adding electric energy, 20: 44926

**FLOTATION**
- use in measuring isotopic composition, 20: 43531

**FLOWMETERS**
- design and fabrication of standards for gravimetric gas, 20: 43633 (K-1632(Pt.1))

**FLUID FLOW**
- boiling hydrodynamics of natural circulation, computer program for, 20: 43479 (JAERI-1108)
- boundary layer, on electrically conductive wall of flat channel, 20: 44406
- equations of motion of viscous, numerical integration of, 20: 44404(R) (AD-628179)
- in multirod reactor fuel bundles, 20: 45051 (RISO-125)
- magnetohydrodynamic, structure of Alfvén shock with finite electric conductivity, (T), 20: 44414
- measurement of water, down slopes and in streams, 20: 43662
- momentum flux measurements for two-phase, 20: 43484(R) (STL-372-38)
- pressure drop in gas-bearing, 20: 43469 (TID-23350)
- pressure drop in isothermal, with electric and magnetic fields, 20: 43490

**FLUID FLOW (LAMINAR)**
- slip ratios in annular two-phase, 20: 43482 (ORNL-TM-1519)

**FLUID FLOW (TURBULENT)**
- heat transfer in two-phase, in glass pipes, 20: 43477 (CONF-661102-1)

**FLUIDIZATION**
- of nuclear fuels, coated particles for use in, 20: 43868
- uses in processing of particulate fuels, review of, 20: 43868

**FLUIDS**
- apparatus and method for determining, blood volume, 20: 43054(P)

**FLUORIDE VOLATILITY PROCESSES**
- design study of continuous fluorination-vacuum distillation, for fuel and fertile streams from molten-salt breeder reactor, 20: 43422 (ORNL-3791)
- use of tellurium and its compounds in, review on properties for, 20: 43164 (ANL-7142)

**FLUORIDES**
- determination in aqueous solutions, microdistillation-colorimetric, 20: 43067(R) (IDO-14679, pp 6-46)
- determination in aqueous solutions, microdistillation-colorimetric, 20: 43071 (IDO-14679, pp 75-191)

**FLUORIMETERS**
- design of reflection, for uranium determination in zircon, 20: 43565

**FLUORINATION**
- use for reprocessing irradiated reactor fuels, problems in, 20: 43413 (EURAEC-1659)

**FLUORINE**
- determination by charged-particle reactions at 2 Mev, 20: 43097
- recovery from process streams, fluid-bed method for, 20: 43199

**FLUORINE IONS**
- detection of negative, design of scintillation detector for, 20: 43735

**FLUORINE ISOTOPES F-18**
- energy-level transitions in, mixing ratios for, (T), 20: 44784

**FLUORINE ISOTOPES F-19**
- gamma reactions $(\gamma,n)$ at 10 to 14 Mev, cross sections for, (E), 20: 44683
- hyperfine splittings of, in hexakis(trifluoromethyl)benzene, effects of temperature on, 20: 43225
- nuclear magnetic resonance spectra of, in paramagnetic plutonium tetrafluoride, 20: 43208

**FOAMS**
- use for decontaminating air containing radioiodine and particulates following nuclear incidents, 20: 43585 (ORNL-TM-1589)

**FONTENAY-AUX-ROSES REACTORS**
- wastes from, process for fixation in glass of, 20: 45233

**FOOD**
- control of food-spoilage organisms on fruits and vegetables, 20: 43780
- fission product contamination of, factors affecting, 20: 43596
- preservation problems in developing countries, 20: 42727
- radiation monitoring of, at Savannah River Plant, January to June 1966, 20: 43577(R) (DPST-66-30-2)
- radiation processing of fruits and vegetables, 20: 42851(R) (NYO-3274-9)
- radiation processing of, facilities for, 20: 43766
- radiation processing of, 1965 Joint Committee hearings on, 20: 43767
- radiation processing of fish fillets, wholesomeness tests in, 20: 43768
- radiation processing of fruits and vegetables for control of insect infestation in stored produce, 20: 43780
- radiation processing of fruits and vegetables, effects on flavor, storage life, and wholesomeness, 20: 43781
- radiation processing of fruits and berries, effects on storage life, gamma, 20: 43782
- radiation processing of fruits and vegetables, effects on storage life, 20: 43783
- radiation processing of, effects on wholesomeness, FAO/WHO/IAEA recommendations on, 20: 43786
- radioactive contamination of, by surface waters, 20: 43598
- radioactive contamination of, Japan, 1961–64, 20: 43615
- radioactivity content of, from fallout in West Germany, 20: 43626
- radioactivity in, effects of iodine isotopes released during nuclear explosions on, 20: 43574 (CONF-660538-1)
- radioinduced toxins in, 20: 43771
- radioinduced toxins in, 20: 43772
- radioinduced volatile compounds giving undesirable odors and flavors in, 20: 42973
- radiopreservation program in United States, 20: 43774
- radiopreservation using electrons, 20: 43794
- radiosensitivity of crude and purified pectic enzyme preparations, used for processing fruit juice, 20: 43785
- strontium-90 content in cereals and flour in Finland, 1963 and 1964, 20: 43006

strontium-90 content of, in East Germany from 1961 to 1963, 20: 43538

**FOOD IRRADIATION FACILITIES**
design and performance of, review of, 20: 43766
design of Marine Products Development Irradiator, Gloucester, Mass., 20: 43774
design of, incorporating swimming pool reactor and cobalt-60 source, 20: 43791
economic survey on, for processing dried or smoked fish in Africa, 20: 43778

**FORENSIC SCIENCE**
nuclear techniques in, bibliography on, 20: 43082 (PEL-116)

**FORESTS**
radiation effects on ecology of tropical, $\gamma$, 20: 42853(R) (ORO-3299-1)

**FORMALDEHYDE POLYMERS**
corrosion of Delrin by flowing water at pH 5 and 100°C, dynamic, 20: 43833 (ORNL-TM-1030)

**FORMAMIDE**
radioinduced addition to olefins, electron and gamma, 20: 43347

**FORMATES**
formates–nitrates, radiolysis of, yields of primary hydrogen during gamma, 20: 43351

**FRANCE**
atomic energy research program in, 20: 45239(R) (NP-16267)
effects of regional and seasonal variations in, on potassium concentrations in milk as determined by gamma spectrometry of potassium-40, 20: 43597
nuclear power development, 20: 45166

**FREE RADICALS**
effects on DNA molecule, site and mechanism of action, 20: 42821
electron spin resonance spectra of, from gamma irradiation of polyethylene terephthalate, 20: 43324
electron spin resonance spectra of, in conjugated dienes, 20: 43325
formation during photolysis of normal and deuterated hydrogen sulfides, effects of temperature on ESR studies of, 20: 43196
formation in radiolysis of *p*-benzhydroquinone and phenol, effects of water elimination reaction on, 20: 43332
radioinduced formation of, in aqueous nitrate solutions, electron, 20: 43321
radioinduced in bacteria, ESR spectra of $\gamma$, 20: 42802
radioinduced in frozen aqueous solutions of sodium nitrite, ESR spectral studies on, 20: 43309
yields from electron-radiolysis of sulfur-containing compounds, EPR studies of, 20: 43330

**FRENCH REACTORS**
development of power and power breeder, 20: 45166

**FRETTING CORROSION**
of SAP, in terphenyl at 400°C, 20: 43843

**FRICTION**
factors affecting wear from, 20: 43788
measurement of, use of Kryptonate beta sources in, 20: 43765
tracer methods for, 20: 43788

**FROGS**
radiation effects on nitrogen metabolism in liver, whole-body gamma, 20: 42787
radiation effects on development of fertilized eggs of, uv, 20: 42839(R) (ANL-7136, pp 154-61)
radiation effects on excitation threshold of nerves of, mechanisms for x, 20: 42868
radiation effects on heart muscles of, 20: 42877

**FRUCTOSE**
separation from other sugars in photosynthetic chamber by paper chromatography, 20: 43402

**FRUCTOSE PHOSPHATES**
radiation effects on metabolism of, in bone marrow, 20: 42822

**FRUITS**
processing of juices from, use of heat and radiation for, 20: 43787
radiation effects on ripening of bananas and papayas, 20: 43783
radiation processing of apples, effects on scald control, 20: 42851(R) (NYO-3274-9)
radiation processing of tropical, effects on flabor, storage life, and wholesomeness, 20: 43781
radiation processing of, effects on ripening, 20: 43781
radiation processing of, effects on storage life, gamma, 20: 43782
radiation processing of, effects on spoilage organisms on, 20: 43784
radiation processing of juices from, 20: 43787
radioinduced calcium release in peach, and subsequent effects on texture, 20: 42815
radioinduced softening, gamma, 20: 42916
radiopreservation using electrons, 20: 43794
radiosensitivity of crude and purified pectic enzyme preparations, used for processing fruit juice, 20: 43785

**FUEL CELLS**
development, 20: 44169
development of, review of, 20: 45184

**FUNGI**
radiation and conventional control of, infesting stored fruits and vegetables, 20: 43780
radiosensitivity of spores of, effects of chemical radiosensitizers on $\gamma$, 20: 43784
radiosensitivity of crude and purified pectic enzyme preparations from, 20: 43785

**FUNGICIDES**
use for control of fungal infestation of stored fruits and vegetables, 20: 43780

**FURAN**
furan–tetrahydrofuran, radiolysis of, yields of hydrogen and carbon monoxide in gamma, 20: 43295

**FURAN, TETRAHYDRO-**
furan–tetrahydrofuran, radiolysis of, yields of hydrogen and carbon monoxide in gamma, 20: 43295

**FURAN, TETRAHYDRO-2-METHYL-**
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313

**FURNACES**
design for induction heating of oxides, 20: 43811(R) (BNWL-269, pp 1.1-28)
design of, for production of metal crystals, 20: 43910(R) (TID-23269)

**G**

**GADOLINIUM**
gadolinium-155 energy levels in, magnetic hyperfine structure of, (E), 20: 44832
ionization potentials of, electron-impact method for measuring, 20: 43235
separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)

**GADOLINIUM ALLOYS**
Al–Gd, gadolinium-155 energy levels in $GdAl_2$, magnetic hyperfine structure of, (E), 20: 44832
Al–Gd, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Gd, crystal structure of intermetallic compound, 20: 43920
Gd–Mn, crystal structure of intermetallic compound, 20: 43918

**GADOLINIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
spectra of erbium and terbium in, magnetic effects on, 20: 43177 (NP-16303)

**GADOLINIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with glycolic and lactic acids, thermodynamic properties of, 20: 43215

**GADOLINIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218

**GADOLINIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
fluorescence of trivalent, in sodium tungstate solution, 20: 43211
fluorescence of trivalent, in potassium oxalate solution, 20: 43212
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
preparation of cerium oxide single crystals containing, (E), 20: 43818
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**GADOLINIUM ISOTOPES**
energy levels of, rotational, (T), 20: 44843

**GADOLINIUM ISOTOPES Gd-153**
gamma spectra, 20: 44634(R) (IDO-17188)

**GADOLINIUM ISOTOPES Gd-154**
energy levels of, octupole vibrational, (T), 20: 44825
energy-level transitions in deformed, E2, (E), 20: 44701
energy-level transitions from samarium-152 $(\alpha,2n)$ reactions at 18 to 20.5 Mev, (E), 20: 44735

**GADOLINIUM ISOTOPES Gd-155**
energy levels in gadolinium and $GdAl_2$, magnetic hyperfine structure of, (E), 20: 44832
gyromagnetic ratios, (E/T), 20: 44791
use for prepoison reactivity control in SNAP reactors, 20: 45193 (CONF-660303, pp 204-9)

**GADOLINIUM ISOTOPES Gd-156**
energy-level transitions from samarium-154 $(\alpha,2n)$ reactions at 18 to 20.5 Mev, (E), 20: 44735

**GADOLINIUM ISOTOPES Gd-157**
gyromagnetic ratios, (E/T), 20: 44791

**GADOLINIUM ISOTOPES Gd-158**
energy levels of, vibrational, (E/T), 20: 44797

**GADOLINIUM OXIDES**

radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
**GADOLINIUM PERRHENATES**
preparation and properties of, 20: 43217
**GADOLINIUM PHOSPHATES**
crystal structure of, infrared spectral studies on, 20: 43219
**GADOLINIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219
**GADOLINIUM SYSTEMS**
Gd–graphite, preparation and properties of intercalation compounds in, (E), 20: 44999
**GAGES**
design for sizing cylindrical pellets, 20: 43474(P)
**GALAXIES**
ejection of quasars by nearby peculiar, ratio of blue-red shifts, 20: 44085
evolution of, charge asymmetry in, 20: 44080(T)
formation and dynamics of radio, 20: 44069 (IPPJ-44(J))
gamma absorption in M87, high-energy, 20: 44084
gas and magnetic field properties of, dynamical state of, 20: 44881
radio-, identification, 20: 44088
**GALLIUM**
critical field and superconducting transitions of pure single crystals of, 20: 44545
determination by charged-particle reactions at 2 Mev, 20: 43097
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
superconducting transition temperatures of, crystallite size effects on, 20: 44552
**GALLIUM ALLOYS**
Ga–Pu, density and viscosity of liquid, 20: 43889 (CONF-660606-39)
Ga–Pu, stability of delta-phase plutonium-base, 20: 43895 (LA-DC-7934)
**GALLIUM ISOTOPES Ga-67**
gamma spectra, 20: 44634(R) (IDO-17188)
**GAMMA RADIATION**
absorption by xenon, cross section for, (E/T), 20: 44642 (JINR-P-2808)
absorption within radio sources of high-energy, 20: 44084
angular correlations of, testing symmetries by, (T), 20: 44806
attenuation by residential structures, measurement of, 20: 43496 (CEX-59.7B(Pt.1))
attenuation in shielding materials, equivalent thicknesses for, 20: 44989
biological effects of bremsstrahlung from 3.5 Mev accelerators, 20: 42796
detection and measurement of, sensitivity of dielectric polymer in instrument for, 20: 43991 (EGG-1183-2096)
detection and measurement in liquid and solid samples, equipment and methods for, 20: 43074 (LA-DC-7831)
detection and measurement of, at altitude of 500 ft above ground in Denver, Colo., area, 20: 43513 (CEX-59.4.26)
detection and measurement of cosmic, design and performance of spark chambers for, 20: 43734
detection of, design and performance of ionization chamber for, 20: 43716
detection of, fabrication of high pressure helium-3 gas scintillation detector for, 20: 43733
detection of, response characteristics of germanium and silicon detectors for, 20: 43701
detection of, sensitivity of glass-base dosimeter with radioinduced optical density changes for, 20: 43679
dose distribution of pelvic, using modified Marburg method, 20: 43047
dose effects on chromosomes in continuously irradiated rat bone marrow, 20: 42951
dose to bone marrow from medical exposure, 20: 43620
dose to rodents from natural sources in Minas Gerais, Brazil, 20: 43606
dosimetry in tissues, performance of low-temperature calorimeters for, 20: 43668(R) (ANL-7136, pp 1-16)
dosimetry of cesium-137 and cobalt-60, in bone and lungs using lithium fluoride thermoluminescent dosimeters, 20: 43747
dosimetry of, for radiobiology using ferro-ferrisulfate, 20: 43696
dosimetry of, for use in control of insects infesting dried or smoked fish, 20: 43778
dosimetry of, from deposited potassium-40 in man and sheep, 20: 42940
dosimetry of, phantom for, 20: 43053(P)
effect on polymerization of vinyl monomers in emulsion systems, 20: 43374
effect on sugar and ascorbic acid content of potatoes, 20: 43773
effect on television equipment, 20: 43472
effects of whole-body, on frog serum protein, 20: 42787
effects of, on mice centrifuged prior to exposure, 20: 42985
effects on acetylcholine content in insect eggs and pupae, 20: 42874
effects on acetylcholine metabolism in nerve tissues of rabbits, 20: 42875
effects on addition of formamide to olefins, 20: 43347
effects on alpha and beta amylases in corn and potato starch, 20: 42798 (NP-16224)
effects on amino acid synthesis in *Micrococcus glutamicus*, 20: 42914
effects on amplitude distribution of boron trifluoride counters, (E), 20: 43756
effects on animals, lethal, 20: 42934
effects on aqueous sodium nitrate solutions, ESR spectral studies on radicals formed by, 20: 43310
effects on aqueous solutions of acetylene, in absence of air, 20: 43341
effects on beans, mutagenic, 20: 42850(R) (NYO-2043-130)
effects on blood picture of chronic lymphocytic leukemia in man following extra-corporeal blood exposure, 20: 43013(R) (ORO-2459-1)
effects on borate glass optical density, 20: 44010
effects on cabbage seeds, 20: 42898
effects on carboxylation of n-pentane, 20: 43333
effects on carrot tissues, physiological, 20: 42851(R) (NYO-3274-9)
effects on chickens, pathological, 20: 42833(R) (ANL-7136, pp 16-46)
effects on chromosome anomalies and seedling height in barley, effects of altitude on, 20: 42894
effects on conditioned response of rats, 20: 42852(R) (ORO-2903-28)
effects on creatine excretion in adrenalectomized rats, 20: 42801
effects on cross linking of polyvinylidene fluoride, 20: 43371
effects on crosslinking of poly(oxyethylene glycol), 20: 43375
effects on crystal lattices, 20: 43987 (BNL-10569)
effects on crystal structure of germanium, (E), 20: 45009
effects on cumene on silica gel, at 37 and −196°C, 20: 43319
effects on cyclohexane and hexane, effects of perfluorocarbons on hydrogen yields in, 20: 43316
effects on diurnal variations in mitotic frequency in Pinus, 20: 42953
effects on DNA molecule, site and mechanism of action, 20: 42821
effects on dodecanethiol, 20: 43345
effects on dogs, comparison of internal and external whole-body exposure, 20: 42836(R) (ANL-7136, pp 109-23)
effects on electric components for SNAP 8, 20: 45194 (NAA-SR-11924)
effects on electric conductivity in rat muscle tissue, 20: 42929
effects on electric properties of MOS field-effect transistors, 20: 43752 (AD-635583)
effects on electron spin resonance spectra of bacteria, effects of cysteamine on, 20: 42802
effects on electron spin resonance spectrum of arsenite ions in calcite crystals, (E), 20: 45010
effects on erythropoietic index and iron content in man, 20: 42908
effects on ethylene-hydrobromic acid and hydrobromic acid-propylene solutions, 20: 43298
effects on ethyltoluene isomers, 20: 43359
effects on *Euglena gracilis*, 20: 42906
effects on F-center formation in potassium chlorides and sodium chlorides, 20: 44996
effects on fat and starch content of cotton pollen, 20: 42896
effects on flavor, storage life, and wholeness of fruits and vegetables, 20: 43781
effects on frozen aqueous solutions of sodium hydroxide, sulfuric acid, and water, EPR spectra of, 20: 43290 (COO-1528-7)
effects on fruits and vegetables, calcium release from, 20: 42916
effects on fungal spores, effects of chemical sensitizer on, 20: 43784
effects on furan and tetrahydrofuran, formation of hydrogen and carbon monoxide in, 20: 43295
effects on gonad development in fruit flies, 20: 42847(R) (NP-16176)
effects on graft polymerization of styrene on cotton fabric, 20: 43299
effects on graft polymerization of polyvinyl chloride with styrene, 20: 43372
effects on ground squirrels, effects of hibernation and temperature on, 20: 42835(R) (ANL-7136, pp 63-80)
effect on growth of animal cells in monolayer cultures, 20: 42943
effects on guinea pigs, pathological, 20: 42833(R) (ANL-7136, pp 16-46)
effects on hardness of crystals of potassium chloride and lithium fluoride, 20: 43304
effects on hibernating ground squirrels, lethal, 20: 42834(R) (ANL-7136, pp 46-63)
effects on human ovaries compared to oophorectomy, 20: 43044
effects on immune reactions in dogs and man following extra-corporeal exposure, 20: 43013(R) (ORO-2459-1)
effects on insect reproduction, 20: 42850(R) (NYO-2043-130)
effects on insulating polymers, induced conductivity, 20: 44997
effects on intestinal absorption of carbon-14-labeled L-alanine in rabbits, 20: 42972
effects on ions of aliphatic or aromatic ketones, ESR studies on effects of solvents in, 20: 43313
effects on isomerization of stilbene in benzene, 20: 43360
effects on liquid 1,2,3,4-tetrahydronaphthalene, mechanism of, 20: 43335
effects on lymph cells in dogs following extra-corporeal exposure, 20: 43013(R) (ORO-2459-1)
effects on lymphatic dynamics, lymph nodes, and lymph vessels following cancer therapy, 20: 42976

effects on lysosomes isolated from rabbit polymorphonuclear leukocytes, 20: 42975
effects on melanin distribution in fish, 20: 42905
effects on methanol glass in hydrocarbon solutes, spectral studies on, 20: 43314
effects on mice, pathological, 20: 42833(R) (ANL-7136, pp 16-46)
effects on mice, protective effects of vaccines, thiophosphates, and AET against, 20: 42992
effects on mice, protective effects of cysteamine on, 20: 42998(R) (EUR-2992.f)
effects on mice, protective effects of indolyl- and mercapto-alkylamines against, 20: 43002
effects on microbial populations on perch fillets following refrigerated storage, 20: 43793
effects on morphology and motility of bull sperm in suspensions, 20: 42950
effects on morphology of cotton plants, 20: 42896
effects on mortality and reproductive behavior of *Ips confusus*, 20: 42883
effects on mouse spermatogenic epithelium, pathological, 20: 42942
effects on optical inversion in poly-L-glutomic acid, 20: 42826
effects on organic compounds, correlation of structural unit with G values of products from, 20: 43296
effects on organic-nitrate systems, yields of primary hydrogen from, 20: 43351
effects on oxycorticosteroid activity in dog liver, 20: 42808
effects on peptide bonds in polyamino acids, 20: 42826
effects on physicochemical properties of polyesters of azelaic, glutaric, and sebacic acids, 20: 43343
effects on plants, effects of content of calcium, magnesium, and potassium in nutrient medium on, 20: 42915
effects on Polyamide 6 (Dederon-Monofil) fibers, 20: 43331
effects on polyethylene terephthalates, 20: 43378
effects on polyethylene terephthalate, ESR of free radicals from, 20: 43324
effects on polymerization of tetrafluoroethylene oxide, 20: 43301
effects on polymerization of styrene in different solvents at −78°C, 20: 43308
effects on polymerization of styrene, $\alpha$-methylstyrene, and isobutyl vinyl ether, 20: 43338
effects on polymerization of styrene, 20: 43339
effects on potassium nitrate, 20: 43329
effects on potassium bromates, kinetics of isothermal annealing of, 20: 43362
effects on propane in presence of argon or xenon, 20: 43368
effects on properties of alkaline phosphatase in solutions, 20: 42819
effects on rabbit brain, pathological, 20: 42862
effects on rabbits, seasonal variations in, 20: 42848 (NP-16256)
effects on radiation-resistant lubricants and fluids, 20: 43493
effects on rat tissue oxygen content, protective effects of barbamyl and serotonin on, 20: 43008
effects on respiration in developing salmon spawn and larvae, 20: 42820
effects on root initiation in Coleus following leaf exposure, 20: 42842(R) (ANL-7136, pp 290-301)
effects on seeds of pure and hybrid winter wheat, 20: 42897
effects on silver valence state in glasses, (E), 20: 44012
effects on sodium cyanide at 300°K, ESR studies of, 20: 43350
effects on solubility and viscosity of adipic acid polyesters, 20: 43342
effects on sorptive properties of quartz for hydrogen and nitrogen, 20: 43302
effects on splitting of amino acids and peptides from myoglobins, 20: 42799(R) (UCB-34P95-1)
effects on sterilization of screw-worm flies, effectiveness compared with chemosterilants, 20: 42724
effects on storage life of potatoes, 20: 43773
effects on surface electrification of polyethylene and polystyrene, 20: 43337
effects on thallium-activated cesium iodide crystals, decay time of scintillation from, 20: 43695
effects on thermal decomposition of thorium oxalate dihydrate, 20: 43363
effects on thermoluminescence of calcites, 20: 43552
effects on toxin production by *Clostridium botulinum*, type E, on fish, effects of polythene packaging and vacuum exposure on, 20: 43779
effects on trivalent plutonium in sulfuric acid solution, 20: 43358
effects on tropical plants, biological, 20: 42850(R) (NYO-2043-130)
effects on tropical rain forest, ecological, 20: 42853(R) (ORO-3299-1)
effects on tulip bulbs and plants, genetic and morphological, 20: 42861(T) (NSJ-tr-53)
effects on viscosity changes in polyamino acid solutions, 20: 42826
effects on water–heavy water mixtures, 20: 43352
effects on water, diffusion kinetics for, (E/T), 20: 43288(R) (CALT-532-1)
effects on yeast, effects of chemical sensitizers on, 20: 43784
effects on yield of early maturing cotton, 20: 42899
effects on 2-propanol solutions, 20: 43318
emission from soil samples, determination of soil parameters by, 20: 43542
energy of hydrogen-neutron-capture, 20: 45046(R) (IDO-17192)
energy release in nuclear decay systematics of, 20: 44821
flux effects on reactor shutdown margin measurements, 20: 45048 (ORNL-P-2311)
flux measurement in Halden reactor, performance of gamma thermometers for, 20: 45111(R) (HPR-68)
gas production in evacuated glass bulbs by, 20: 44011
heating effects on infinite cylinders, calculations for uniformly distributed sources, 20: 45050 (ORNL-TM-1260)
inactivating effect on enzymes, comparison with alpha radiation, 20: 42816
inactivation in transforming DNA in the presence of inhibitors, 20: 42818
induction of chromosome breaks in *Vicia faba*, effects of dinitrophenol on, 20: 42913
induction of gastric ulcers by therapeutic doses of, directed to lumbar lymph nodes, 20: 43019
lethal dose of insects infesting stored products, determination of, 20: 42904
polarization of, design and perfomance of polarimeter for, 20: 43683
production in solar flares, properties of, 20: 44093
production of liver changes in rats by, effects of dietary casein levels, 20: 42864
protection from, review of aperture and ceiling-shine effects in, 20: 43526
reactions $(\gamma,n)$ with heavy nuclei, method for studying energy levels using, 20: 44631 (CONF-660303, pp 1064-72)
reactions $(\gamma,n)$ and $(\gamma,2n)$ with oxygen-16 and zirconium isotopes, cross sections for, (E), 20: 44660 (UCRL-70002)
reactions $(\gamma,n)$ with elements and compounds, (E), 20: 44681
reactions $(\gamma,n)$ with fluorine-19 at 10 to 14 Mev, cross sections for, (E), 20: 44683
reactions $(\gamma,n)$ and $\gamma,2N)$ with holmium-165 from threshold to 19.6 Mev, (E), 20: 44710
reactions $(\gamma,n)$ and $(\gamma,p)$ with medium and heavy nuclei, mechanism of, (E), 20: 44778
reactions $(\gamma,n)$ and $(\gamma,p)$ with helium-3, (T), 20: 44823
scattering at small angles, incoherent component in coherent, (E/T), 20: 44147
scattering by holmium-165 at 12.6 and 16.4 Mev, elastic, (E), 20: 44710
scattering by nuclei with $Z = 72$ at 92 to 0.511 Mev, elastic, (E), 20: 44829
scattering calculations for density gages, (T), 20: 43647
transport in compartmented structures, Monte Carlo computer code for, 20: 44987 (AD-637685)
use for radiopreservation of sea foods, 20: 43774
use for radiopreservation of fish and sea foods, 20: 43776
use for therapy of skin metastases, 20: 43039
use in Canada, program for, 20: 43759 (AECL-2298(Vol.4))
use in detecting flaws in hot-rolled metal ingots, 20: 43870
use in radiopreservation of fish, 20: 43770
use in therapy of bronchogenic cancer, injuries to lungs following, 20: 43030

**GAMMA SHIELDING**
effect of apertures and ceiling-shine on, 20: 43526

**GAMMA SOURCES**
dose measurements on distributed, performance of sodium iodide scintillation system for, 20: 43668(R) (ANL-7136, pp 1-16)
dosimetry measurements using cobalt-60 well irradiator, 20: 43613
dosimetry of cobalt-60 slab, used in industry, 20: 43621

**GAMMA SPECTRA**
analysis of complex, in activation analysis, Simplex method of linear programming for, 20: 43159
analysis of high-energy, method for, 20: 43702
analysis of photopeak centers in, methods for, 20: 44718
analysis of, computer program for, 20: 43512(R) (ANL-7136, pp 315-27)
compilation of, for radioisotopes, secondary standardizations from, 20: 43380 (ORNL-P-2432)
measurement from europium- and promethium-149 decay, 20: 45046(R) (IDO-17192)
resolution of, computer program for determining radioisotopes by least-squares, 20: 43078 (ORNL-3975)
tables of, for neutron-deficient nuclides, 20: 44634(R) (IDO-17188)

**GAMMA SPECTROMETERS**
calibration of Mössbauer, using iron-57 enriched metallic iron, 20: 43607
description of telescopic scintillation pair, for measuring spectra from radiative capture of 14-Mev neutrons, 20: 43708
design and energy resolution of germanium p-i-n, 20: 43684
sensitivity of, effects of dielectric polymers on, 20: 43991 (EGG-1183-2096)

use in determining cesium and rubidium in blood fractions, 20: 42778
use in determining potash content of igneous rocks, 20: 43507(R) (COO-689-60, App.A-7)
use in determining radionuclides in upper atmosphere, 20: 43524
use of lithium-drifted germanium detector as, for determining iron in presence of silicon, 20: 43081 (ORO-2980-13)
use of, for determining radionuclides in food, 20: 42735
use of, for identifying electromagnetic radiation from ceramic spheres containing manganese-54 or uranium carbide particles, 20: 42740 (LA-DC-7764)

**GAMMA SPECTROSCOPY**
semiconductor counter use in, 20: 43737
use for analyzing radioactive materials, 20: 43069(R) (IDO-14679, pp 51-9)
use in determining soil parameters for estimation of trafficability, 20: 43542

**GARIGLIANO POWER REACTOR**
maintenance and repair, 20: 45122(R) (TID-23321)
operation and maintenance, 20: 45121(R) (TID-23320)
operations, 20: 45122(R) (TID-23321)

**GAS COOLED REACTORS**
containment for fast breeder, optimization of secondary, 20: 45117 (ORNL-TM-1194)
core design for fast breeder, 20: 45117 (ORNL-TM-1194)
design, 20: 45170
development of steam, Karlsruhe, 20: 45148
development of steam-cooled fast breeder, 20: 45150
fuel elements for, heat transfer from roughened surfaces of, 20: 43487
fuel elements for, heat transfer from roughened surfaces of, 20: 43488
fuel fabrication and evaluation for high-temperature, 20: 43860 (SGAE-CH-35/1966)
fuel pins for fast breeder, performance of, 20: 45117 (ORNL-TM-1194)
operation of, public health evaluation of hazards from, 20: 43632
particle deposition in, counting, sizing, and sampling of Aitken, 20: 45055
safety of, effects of neutron cross section uncertainties on, 20: 45068 (CONF-660303, pp 430-53)
use in U. K. nuclear power program, 20: 45179

**GAS FLOW**
Boltzmann-Ulasov equation for, general spherical harmonic tensors of, 20: 44914
design and fabrication of standards for gravimetric, 20: 43633 (K-1632 (Pt.1))
in fluidized and packed beds, 20: 43483(R) (RPI-3639-1)
magnetohydrodynamic, hydraulic calculations for analysis in channel, 20: 44407
magnetohydrodynamic, hysteresis phenomena in, 20: 44411
magnetohydrodynamic, electric conductivity of vortex, 20: 44412

**GASEOUS FUEL REACTORS**
fuel separation from propellant in rocket, (T), 20: 45201

**GASES**
analysis for carbon, nitrogen, oxygen, carbon-14, nitrogen-15, oxygen-17, and -18, activation methods for, 20: 43115
decontamination of, in solid waste incineration plants, 20: 45214 (AEET-243)
electric conductivity of partially ionized, 20: 44163(R) (AD-628528)
electric discharges in, magnetic field effects on, (E), 20: 44917
electric discharge in, high frequency ion-wave propagation in, 20: 44930
electron avalanches in, charge imaging on insulating foils, (E), 20: 43743
electron motion in, with randomly distributed positive charges, (T), 20: 44393
heat transfer by longitudinal flowing, in rod bundles, 20: 43489
neutron scattering by, in effective width model, (T), 20: 44595
radioactivity of, ionization chamber for measuring, 20: 43106
radioinduced formation in uranium, mechanism of, 20: 43995 (JAERI-4037)
radioprotective effects on *Vicia faba* seedlings, 20: 43007
reactions with metals, computer program for calculating weight gains in, 20: 43898 (NAA-SR-Memo-11967)
thermodynamics of, boson and fermion distributions for, 20: 44113
use in spark chambers, filling and purification system for, 20: 43724

**GASKETS**
performance of, for main flange of Halden reactor vessel, 20: 45111(R) (HPR-68)

**GASTROINTESTINAL TRACT**
radiation dose to, from insoluble and soluble strontium-90, 20: 43631
radiation doses to, from ingested radioisotopes, calculation of, 20: 43043
radiation effects on absorption of water by rat, x, 20: 42971
radiosensitivity of, 20: 42865
radiosensitivity of, in man and monkeys, 20: 42934
transit time of ceramic spheres containing manganese-54 or uranium carbide particles in, of animals and man, 20: 42740 (LA-DC-7764)

**GEIGER-MUELLER TUBES**
dead time and fatigue in self-quenching, at 0 to 120°C, 20: 43710
performance of activable-cathode, for fast neutron flux measurements, 20: 43729
use in determination of absolute beta activity in solutions, 20: 43697

**GENES**
effects on radiosensitivity, life span, brain structure, and behavior of mice, 20: 42833(R) (ANL-7136, pp 16-46)
effects on tumor formation on tobacco plants, 20: 42704 (BNL-967)
radiosensitivity effects of dominance and recessiveness in barley, x, 20: 42923

**GENETICS**
advantages of *Arabidopsis thaliana* as experimental plant, 20: 42900
artificial cross-pollination methods using *Arabidopsis*, 20: 42900
chromosome function and structure, 20: 45243 (UCRL-14625(Rev.1))
radioinduced variability for quantitative traits, use in plant breeding programs, x, 20: 42846 (IAEA-2466-13)
relation of DNA synthesis to genetic recombination in *Escherichia coli*, 20: 42838(R) (ANL-7136, pp 140-54)
selection of irradiated cotton for improved yields, 20: 42899
space flight effects on pine and wheat seeds, 20: 42912

**GEOCHEMISTRY**
progress report on, Carnegie Inst. of Tech., 20: 43550(R) (NYO-844-67)
use of isotopes in determining Pleistocene climatic record, 20: 43557

**GEOLOGY**
bibliography on, 20: 43500(R) (COO-689-60)
effects of mountain building on climate, 20: 43505(R) (COO-689-60, App.A-5)
of Denver, Colo., area, γ aerial survey of, 20: 43513 (CEX-59.4.26)
thermoluminescence in geological problems, 20: 43987 (BNL-10569)

**GEOMAGNETIC FIELDS**
charged-particle motion in vicinity of neutral point of, 20: 44460
charged-particle trajectories in, (T), 20: 44461
disturbances during 1957–59, Forbush decreases associated with, 20: 44420
effects of magnetospheric-ionospheric electric currents on N-S asymmetry of $S_q$, (E/T), 20: 44438
effects on horizontal drift and anisotropy in ionospheric F1 layer, (E), 20: 44440
effects on muon production height in air showers, (T), 20: 44418
inflation by ionized gas, nonsymmetric, (T), 20: 44443
intensity variations of, spectral analysis of, 20: 44451
interactions with solar plasma, 20: 44069 (IPPJ-44(J))
plasma-sheet motion in, cylindrical, (E/T), 20: 44415 (AD-628320)
shielding of accelerators from, method for improved, 20: 44060
solar corpuscular stream interactions with, (T), 20: 44439
trapped particle shells in, model for, 20: 44416 (AD-639436)

**GEOMAGNETIC STORMS**
amplitudes of sudden commencements following cosmic-ray flares, 20: 44466
disturbance daily variation of, asymmetric ring-current effect on low-latitude, (E/T), 20: 44444
effects on auroral-zone microbursts, 20: 44453
effects on directional distribution of cosmic mesons, 20: 44422
effects on low-energy electron flux in outer radiation belt, (E), 20: 44454
occurrence during 1957–59, Forbush decreases associated with, 20: 44420
occurrence of, charged-particle inflation of inner magnetosphere during, (E), 20: 44445
occurrence of, correlations with associated phenomena, 20: 44477
occurrence, thermosphere energetics related to, 20: 44465
solar plasma cloud producing, acceleration of, 20: 44471
sudden commencement and Forbush decreases, correlation of, 20: 4441

**GERMANIUM**
determination of, in titanium oxides by photoactivation methods, 20: 43102
radiation effects on single crystals of, electron, 20: 44998
radiation effects on crystal structure of, electron and gamma, (E), 20: 45009
response to gamma rays, Monte Carlo calculation of characteristics of, 20: 43701
separation from other elements by ion exchange using triisoöctylamine, 20: 43439

**GERMANIUM ISOTOPES Ge-69**
energy levels of, from germanium (γ,n) reactions at 0.16 to 1.32 Mev, 20: 43102

**GERMANIUM ISOTOPES Ge-70**
energy levels of, $0^+$, (T), 20: 44647 (NIJS-R-484)

**GERMANIUM ISOTOPES Ge-72**
energy levels of, $0^+$, (T), 20: 44647 (NIJS-R-484)

**GERMANIUM ISOTOPES Ge-74**
energy levels of, $0^+$, (T), 20: 44647 (NIJS-R-484)
proton scattering by, isobaric analog states from, (E), 20: 44761

**GERMANIUM ISOTOPES Ge-76**
energy levels of, $0^+$, (T), 20: 44647 (NIJS-R-484)
neutron reactions $(n,\gamma)$ with, isomer ratios from, 20: 44816

**GERMANIUM OXIDES**
$GeO_2$–$TiO_2$, determination of germanium in, by photoactivation methods, 20: 43102

**GERMANY**
radiation dose to professional personnel from occupational exposure, 1964, 20: 43614
strontium-90 contamination of animal and plant foods in East, 20: 43538
therapeutic use of thorium X in dermatology and spondylitis, 20: 43046

**GIBBERELLIC ACID**
effects on phosphorus metabolism in *Vicia faba*, tracer study, 20: 42771

**GLASS**
analysis for antimony, activation, 20: 43080 (ORO-2670-15)
bibliography on radiophotoluminescence, 20: 43689
electric properties in high vacuum, 20: 44043(RHEL-R-124)
heat transfer in packed beds of, in stagnant air, 20: 43483(R) (RPI-3639-1)
ion beam effects on surfaces of, 20: 45017
oxygen-16/-18 ratio of Bosumtwi Crater, 20: 43511
oxygen-16/-18 ratio of moldavite, 20: 43511
radioactive waste fixation in, process for, 20: 45231
radioactive waste fixation in, process at Fontenay-aux-Roses, France for, 20: 45233
radioinduced atomic silver in, gamma, (E), 20: 44012
radioinduced gases in evacuated bulbs of, gamma, 20: 44011
sorptive properties of, for barium, calcium, iodide, and strontium ions, tracer studies of, 20: 43251
use as cathode material in electrostatic beam separator, (E), 20: 44046
charcoal–glass, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)
glass–polytetrafluoroethylene, iodine retention on filters of, 20: 43067(R) (IDO-14679, pp 6-46)

**GLASS FILTERS**
iodine retention on, in air–steam and helium atmospheres, 20: 43067(R) (IDO-14679, pp 6-46)
thermal stability of, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)

**GLASS TEXTILES**
radioinduced graft polymerization of styrene, vinylphosphonic acid dichloranhydride, and vinylpyridine on, 20: 43311

**GLOBINS**
effects of acidity on autoxidation of oxyhemo- and oxymyo-, 20: 42799(R) (UCB-34P95-1)
radiation effects on splitting of amino acids and peptides from sperm whale myoglobins, gamma, 20: 42799(R) (UCB-34P95-1)
radiation effects on bonding of tuna myoglobins with malonaldehyde, 20: 42799(R) (UCB-34P95-1)

**GLOBULIN**
content in circulating blood, effects of marrow transplants treated with cortisone or nitrogen mustard on, 20: 42995
effects of cholesterol-rich fractions of, on esterase activity in kidneys and liver of x-irradiated rats, 20: 42824
radiation effects on properdin of blood serum, denaturation by ultraviolet, 20: 42823
zinc-65 bonding in guinea-pig serum, 20: 42791

**GLOVE BOXES**
development for plutonium ceramics, 20: 43811(R) (BNWL-269, pp 1.1-28)
leaks in, hazards from, 20: 43630

**GLOW DISCHARGES**
energy balance in steady-state, in argon and xenon, 20: 44961
plasma beam production from, 20: 44900

**GLUCOSE**
radiation effects on metabolism in rats, x, 20: 42856 (TID-23213)
separation from other sugars in photosynthetic chamber by paper chromatography, 20: 43402

**GLUCOSE PHOSPHATES**
radiation effects on metabolism of, in bone marrow, 20: 42822

**GLUCURONIDASE**
content in urine of uterine carcinoma patients following radiotherapy, 20: 43025

**GLUTAMIC ACID**
metabolism of carbon-14 labeled, in mice with Ehrlich's ascitic carcinoma, 20: 42728
poly-L, gamma-induced optical inversion of, 20: 42826
poly-L, gamma-induced viscosity changes in, 20: 42826
radiation effects on synthesis in *Micrococcus glutamicus*, fast neutron and $\gamma$, 20: 42914

**GLUTARIC ACID, ESTER POLYMERS**
radiation effects on physicochemical properties of, 20: 43343

**GLUTATHIONE**
radiation effects on content of oxidized and reduced, in bone marrow, 20: 42822

**GLYCEROL**
radiolysis of, correlation of structural unit with G values of products from gamma, 20: 43296

**GLYCINE**
L-histidyl, spectra of deuterated imidazole group in, PMR, 20: 43281
spectra of normal and oxygen-18-labeled, in 1650 to $650\text{-cm}^{-1}$ band, infrared absorption, 20: 43283

**GLYCOLIC ACID COMPLEXES**
with lanthanide ions, thermodynamic properties of, 20: 43215

**GLYCOSIDES**
effects on reduction of pyridine nucleotides in rat liver slices, 20: 42759
effects on sodium ion efflux from rat liver slices, 20: 42758
effects on sodium ion efflux from rat liver slices, 20: 42759

**GOATS**
calcium-47 kinetics in, 20: 42739(R) (COO-1339-9)

**GOLD**
alpha particle energy loss and straggling in foils of, 20: 44144
alpha scattering at 60°, 20: 43742
deposition on thallium, effects of, on properties as beta source at 300 to 500°C, 20: 43400
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
electric conductivity of thin films of, charge effects on, 20: 44510
electron and proton diffraction channelling in crystals of, fast, 20: 44134
electron reactions at 18 Mev, anomalous secondary electron emission from, 20: 44117
electron scattering at 3.5 to 14.1 Mev on, backscattering from, (E), 20: 44115
electron scattering at 3.2 to 14.1 Mev, backscattering energy distributions from, (E), 20: 44116
photoelectric and optical properties of films of, in extreme ultraviolet, (E), 20: 44995 (ORNL-TM-1392)
properties for coating metals, 20: 43880
radioinduced defects in, recovery from, (E/T), 20: 45040
separation from other elements by ion exchange using triisoöctylamine, 20: 43439

**GOLD ISOTOPES Au-186**
nuclear data sheets, 20: 44713

**GOLD ISOTOPES Au-187**
nuclear data sheets, 20: 44714

**GOLD ISOTOPES Au-188**
nuclear data sheets, 20: 44715

**GOLD ISOTOPES Au-189**
nuclear data sheets, 20: 44716

**GOLD ISOTOPES Au-197**
neutron capture cross section discrepancies for, explanation by boron $(n,\alpha)$ cross sections in flux monitoring, 20: 44611 (CONF-660303, pp 486-501)
proton reactions $(p,n)$ at 8 to 14 Mev, neutron spectra from, (E), 20: 44739
separation from neutron-deficient mercury-195, 20: 43067(R) (IDO-14679, pp 6-46)

**GOLD ISOTOPES Au-198**
effects on lymphatic dynamics, lymph nodes, and lymph vessels following cancer therapy, 20: 42976
production of, review of methods for, 20: 43399
use in radiotherapy, 20: 42796

**GONADOTROPIC HORMONES**
use for assessing castration in human females, 20: 43044

**GONADS**
clinical aspects, histopathology, and therapy of tumors in testicular, 20: 43038
diagnosis and therapy of malignant tumors of testis, 20: 43034
radiation doses to human, from diagnostic radiography, calculation procedure for, 20: 43026
radiation effects on development of fruit-fly, 20: 42847(R) (NP-16176)
radiation effects on protein metabolism in rabbit ovaries, x, 20: 4294
radioinduced histological changes in rat testes, x, 20: 42961
radiosensitivity of, 20: 42865
radiosensitivity of mouse spermatogenic epithelium, $\gamma$ and x, 20: 42942
radiotherapy of testicular, following orchiectomy, 20: 43038
shielding of, during electron beam therapy, 20: 43012 (BMwF-FBK-66-03)
use of testis weight as indicator of x radiation effects on mice, 20: 42841(R) (ANL-7136, pp 266-89)

**GRAIN STRUCTURE**
crystallization effects in argon, krypton, and vacuum, on tungsten, 20: 43937
effects on properties of sintered cobalt–tungsten carbide systems, 20: 43878

**GRANITES**

age of, in central and north Japan, 20: 43556
lead isotope ratios for, of North and Central Japan, 20: 43556
**GRAPHITE**
containment of liquid niobium and zirconium carbides in crucibles of, at 3800 to 4700°K, 43174 (NASA-CR-608)
corrosion of irradiated, 20: 45114(R) (NP-16272)
elastic properties of highly oriented pyrolytic, effects of fast neutron irradiation on, 20: 44018
electric conductivity of compacts of, at 20 to 1000°C, (E), 20: 43929
electron spin resonance of polycrystalline, effects of doping on, (E), 20: 44008
machining procedures for foam, 20: 43864 (Y-1550)
neutron diffusion length measurements in AGOT, Bragg-induced cold neutron effects in, 20: 44585 (NAA-SR-Memo-11866)
neutron energy spectra in blocks of, 20: 45060
oxidation by air, effects of chlorofluoromethanes on, (E), 20: 43839
radiation effects on dimensions of, two-phase model for neutron, (T), 20: 44007
radiation effects on electron spin resonance of, neutron, (E), 20: 44008
radiation effects on elastic modulus of pyrolytic, 20: 44018
radioinduced dimensional changes in crystals of, fast neutron, 20: 44020
radioinduced interstitial cluster growth in, fast neutron, 20: 44021
radioinduced stresses in columns of, cross-sectional shape effects on, 20: 44000 (ORNL-TM-1574)
reactions with niobium at 1700 to 2300°C, kinetics of, 20: 43954
testing silicon carbide-coated under irradiation, oxidation, and thermal cycling conditions, 20: 43825 (BNWL-242)
thermal conductivity of ZTA, at 23 to 2700°C, 20: 43896 (LA-DC-8163)
thermal conductivity of compacts of, at 20 to 1000°C, (E), 20: 43929
**GRAPHITE SYSTEMS**
Cs–graphite, stability, structure, and thermodynamic properties of phases in, at 400 to 800°C, (E), 20: 43948
Dy–graphite, preparation and properties of intercalation compounds in, (E), 20: 44999
Er–graphite, preparation and properties of intercalation compounds in, (E), 20: 44999
Gd–graphite, preparation and properties of intercalation compounds in, (E), 20: 44999
graphite–UC, electric and thermal conductivity at 20 to 1000°C, (E), 20: 43929
graphite–Tb, preparation and properties of intercalation compounds in, (E), 20: 44999
graphite–Ho, preparation and properties of intercalation compounds in, (E), 20: 44999
graphite–Tm, preparation and properties of intercalation compounds in, (E), 20: 44999
graphite–Yb, preparation and properties of intercalation compounds in, (E), 20: 44999
**GRASS**
analysis for metals, activation, 20: 43060 (CEA-R-2967)
cesium-137 content in relation to precipitation and harvest yield, 20: 43527
iodine-131 levels in, after Chinese nuclear explosion, 20: 43608
strontium-90 content in, in Japan, 1963–64, 20: 43610
**GRAVITATION**
book: *The Quantum Equation and the Theory of Fields*, 20: 44401
collapse of quasars, irreversibility of, 20: 44082
collapse of, oscillatory motion of, 20: 44106
effects on atmospheric red shift, route dependence of, 20: 44490
effects on development and growth of corn and oat plants during satellite motion, 20: 42703(R) (ANL-7136, pp 302-14)
effects on phage induction and viability of *E. coli* during space flight, 20: 42910
equations for, singularities in solutions of, 20: 44107
field of axially symmetric rotating fluid mass in general relativity, 20: 44495
theory for, review of, 20: 44498
theory of, conformal, 20: 44497
**GREAT BRITAIN**
strontium-90 accumulation in bones from contaminated diet, 20: 43619
strontium-90 uptake and retention by humans in, equations for, 20: 42762
waste processing and disposal methods in, 20: 45222
**GROUND WATERS**
contamination by fission products, method for preventing, 20: 43522
isotopic composition of, from Tarnobrzeg sulfur mines, 20: 43531
**GROWTH**
dynamics of relative, of embryos and young animals, measurement of, 20: 42840(R) (ANL-7136, pp 164-90)
of Paramecium cultures, effects of natural ionizing radiation, 20: 42886
radiation effects on cells from mouse experimental fibrosarcoma, x, 20: 42888
rate of, in pulmonary metastases, 20: 43033
relationship of, to potassium-40 measurements in sheep and swine, 20: 42739(R) (COO-1339-3)
**GUANINE**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
**GUANOSINE**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
**GUANOSINE, 2′-DEOXY-**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
**GUINEA PIGS**
acceleration tolerance of, effects of radioprotective agents on, 20: 4300
blood of, content of histamine and histamine-like substances following cysteamine injection, 20: 42982
immune reactions to Trichinella infections, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on, $\gamma$, 20: 42833(R) (ANL-7136, pp 16-46)
radiation effects on immune reactions to toxin in, 20: 42878
radiation effects on production of diphtheria and tetanus antibodies, x, 20: 42887
radiation effects on skin of, protective effects of cysteamine against, 20: 42990
zinc-65 distribution in serum protein fractions, 20: 42791
**GULF OF MEXICO**
analysis for copper, manganese, and zinc, activation, 20: 43085(R) (TID-23295, Sect.2)
analysis for rare earth elements by cation exchange, 20: 43087(R) (TID-23295, Sect.4)
analysis for ruthenium, activation, 20: 43086(R) (TID-23295, Sect.3)
**GUNDREMMINGEN POWER REACTOR**
construction of, PERT planning in, 20: 45161

## H

**HAFNIUM**
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
properties as neutron poison, annotated bibliography on, 20: 45080
properties for coating metals, 20: 43880
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
**HAFNIUM ALLOYS**
corrosion in oxidizing atmospheres at high temperatures, 20: 43842
Hf–Ta, corrosion in oxidizing atmospheres at high temperature, 20: 4384
Hf–Ta–W, fabrication and properties of T-111 for corrosion loops, 20: 43830(R) (NASA-CR-72029)
Hf–Ta–W, fabrication of T-111 tubes for corrosion loops, 20: 43831(R) (NASA-CR-72057)
Hf–Ta–W, joining of T-111 to type 316 stainless steel, 20: 43830(R) (NASA-CR-72029)
Hf–Ta–W, welding of T-111 to niobium–zirconium alloy, 20: 43830(R) (NASA-CR-72029)
Hf–Zr, ductility and thermal expansion, 20: 43964
**HAFNIUM BORIDES**
oxidation at 1200 to 2000°K, kinetics of, 20: 43840
**HAFNIUM CARBIDES**
C–HfC, electric conductivity up to 1600°C, 20: 43917 (USBM-RC-1113)
**HAFNIUM FLUORIDES**
determination in presence of zirconium fluorides by x-ray diffraction, 20: 43206
properties of, comparison with zirconium fluorides, 20: 43206
**HAFNIUM ISOTOPES**
energy levels of, rotational, (T), 20: 44843
**HAFNIUM ISOTOPES Hf-178**
neutron reactions $(n,\gamma)$ with, energy-level transitions in isomeric hafnium-179 from, (E), 20: 44709
**HAFNIUM ISOTOPES Hf-179**
energy-level transitions in isomeric, from hafnium-178 $(n,\gamma)$ reactions, (E), 20: 44709
**HAFNIUM OXIDES**
effects on properties of tungsten powder, 20: 43899 (NASA-TN-D-3610)
**HAIR**
radiation effects on tensile strength of rat vibrissae, x, 20: 42834(R) (ANL-7136, pp 46-63)
strontium-90 concentration in, of beagles on chronic ingestion regimen of the radionuclide, 20: 42780
**HALDEN BOILING REACTOR**
development and operation, Apr.-June 1966, 20: 45111(R) (HPR-68)
operation and performance, 20: 45164
**HALIDE COMPLEXES**
lanthanide, preparation and properties of, 20: 43231
**HANDBOOKS AND MANUALS**

on environmental monitoring in emergency situations, 20: 43589 (STI-PUB-118)
on welding qualifications, 20: 43821

**HANDLING AND STORAGE**
container system for radioactive-materials, 20: 43476(P)

**HANFORD PRODUCTION REACTORS**
zinc-65 uptake from effluents of, by Pacific Ocean plankton, 20: 43545

**HANFORD PRODUCTION REACTORS (D)**
coolant processing using sodium silicates, 20: 45215 (BNWL-282)
effluent radionuclide levels, effect of sodium silicates on, 20: 45215 (BNWL-282)

**HANFORD PRODUCTION REACTORS (N)**
operation of, deta processing applications to, 20: 45191 (RL-GEN-1058)

**HARWELL SYNCHROTRON**
beam electrostatic inflector for, performance of glass and ceramic insulators on, 20: 44043 (RHEL-R-124)

**HASTELLOY X**
mechanical properties of base and weld metals of, effects of aging on, 20: 43888 (BNWL-290(Pt.1))
oxidation by air at 1750°F, effects of cobalt content on, 20: 43838 (TID-23319)
radiation effects on properties of, neutron, 20: 45106(R) (ANL-7249)
stress-rupture properties of irradiated, effects of preirradiation thermomechanical treatment on, 20: 43887 (BNWL-231)

**HAYNES 25 ALLOY**
mechanical properties of, effects of aging on, 20: 43888 (BNWL-290 (Pt.1))

**HEAD**
radiation effects on, x, 20: 42925
radiation effects on infantile rat, related to spermatogenesis, 20: 42961

**HEALTH PHYSICS**
abstracts on, 20: 43591(R) (UR-49-687, pp 132-47)
measures for safe operation of nuclear power plants, 20: 43632
problems in, review, 20: 43602
research programs at Chalk River on, 20: 45234 (AECL-2460)
safety measures for reactor fuel manufacture, 20: 43630

**HEART**
effects of dipyridamole-induced vasodilatation on blood circulation in dog, tritiated water tracer of, 20: 42763
radiation effects on muscles of frog and rabbit, 20: 42877
radioisotope studies of function in, 20: 43051
rubidium-86 uptake and distribution in tissues of, mechanisms involved in coronary circulation, 20: 42749

**HEAT**
effects on properdin titer of human and rat serum, 20: 42823

**HEAT EXCHANGERS**
heat transfer analysis in reactors, temperature-enthalpy diagram for, 20: 45174

**HEAT-RESISTING ALLOYS**
development for structures used in oxidizing atmospheres, 20: 43842
properties of boron–molybdenum–nickel, 20: 43973
thermal expansion coefficients of, 20: 43964

**HEAT TRANSFER**
analysis for reactor steam systems, temperature-enthalpy diagram for, 20: 45174
analysis of, rod bundles in longitudinally flowing gases, 20: 43489
boiling potassium, in circular tubes, 20: 43485
burnout heat flux, effect of inlet flow conditions on, 20: 43478 (EURAEC-1620)
coefficients for, in fluidized and packed beds, 20: 43483(R) (RPI-3639-1)
effect of pressure pulsation on burnout, 20: 43478(R) (EURAEC-1620)
effect of vapor content on, by boiling potassium in tubes, 20: 43485
from gas-cooled reactor fuel elements, 20: 43487
from gas-cooled reactor fuel elements, 20: 43488
in flat channel with electrically conductive wall, 20: 44406
in gas-cooled fast reactors, calculations of, 20: 45117 (ORNL-TM-1194)
in two-phase flow at low pressures, 20: 43477 (CONF-661102-1)
pressure oscillations in two phase H, 20: 43480 (LA-3543)
subcooled nucleate boiling in orthoterphenyl, 20: 43486
temperature variations in, effect on mechanical properties of steel, 20: 43456(T) (ORNL-tr-1348)

**HEAT TRANSFER SYSTEMS**
design for organic Rankine cycle working fluid, 20: 43497(R) (SAN-651-1)

**HEAT TREATMENT**
effects on ductility of irradiated steel, 20: 43997(R) (NRL-Memo-1663)

**HEATERS**
design of sheathed electric, for high uniform thermal conductance, 20: 43465 (AECL-2592)
perfomance of turbocompressor test loop, 20: 43481(R) (NYO-3237-6)

**HEAVY WATER REACTORS**
blanket gas for, gas chromatogram for detection of impurities in, 20: 43157
construction of, evaluation of problems in, 20: 45057
fuel burnup and economics of thorium breeder, 20: 45153
fuel cycle for CANDU- and PHWR-type, evaluation of thorium, 20: 45105 (AEET-252)
fuel cycle optimization of organic-cooled, 20: 45185
fuels for, supply in 1970–1985 period, 20: 45118 (RISO-M-434)
kinetics of JRR-3, analog and digital analysis of pseudo-random binary signals for, 20: 45213
neutron kinetics of PPR, calculation of, 20: 45104 (AEET-239)
neutron spectra in, differential and integral thermal (E/T), 20: 45090
neutron transport in, (T), 20: 45066 (CONF-660303, pp 151-70)

**HELIUM**
analysis of reactor blanket gas of, for impurities, gas chromatogram for, 20: 43157
current-voltage curves for negative bias probes in plasma of, (E), 20: 44909
effects on mechanical properties of steels at 1100°F, 20: 43897 (MSAR-66-174)
electron extraction from liquid, potential barrier effects on, 20: 44556
electron scattering by, Mott evaluation of, 20: 44114
electronic recombination in afterglow plasma of, 20: 44854 (AD-630074)
evaporation of liquid, due to high-current carrying loads, (E/T), 20: 44509
excitation by electron impact in plasma of, singlet and triplet population in, (T), 20: 44888
fission fragment energy-losses in, (E), 20: 44685
flow of liquid II, stability between rotating cylinders, 20: 44555
friction in rotating liquid II, angular dependence of mutual, (E), 20: 44539
hydrodynamics of liquid II, quantization of, 20: 44563
hydrogen-ion reactions at 4.5 to 60 kev, cross sections for, (E), 20: 44138
internal energy data and P-V-T at 4.2 to 20°K, (E), 20: 44507
ion resonance in weakly ionized plasma of, 20: 44889
ion temperature in plasma of, Echelle monochromator for measuring, (E), 20: 44920
ionization in gas discharge shock tubes, preliminary photo-, 20: 44980
phase transitions of rotating, I–II, (T), 20: 44563
positron annihilation in, 20: 44246
production by thermal neutron reactions with boron glass, 20: 44011
proton reactions with, cross sections for double electron capture by 2- to 50-kev, (E), 20: 44140
purification of reactor coolant, 20: 45114(R) (NP-16272)
release from irradiated beryllium, 20: 45046(R) (IDO-17192)
scattering of molecular beams of, by silver single crystals, (E), 20: 44121
second sound attentuation in rotating liquid II, mutual friction from, 20: 44539
superfluid, dissipation and critical velocities in, (T), 20: 44503 (LA-DC-8165)
temperature of neutral atoms of, in C-stellarator discharges, (E), 20: 44911
use of liquid, in diffusion pumps, 20: 43498

**HELIUM IONS**
capture of solar, using aluminum foils, 20: 44697
effects on glass surfaces up to 30 kev, 20: 45017
energy in ionosphere, thermal conduction effects on, 20: 44430
reactions with nuclei, elemental surface analysis by, 20: 43097
reactions with tungsten surfaces at 60 ev to 1 kev, entrapment during, 20: 44118

**HELIUM ISOTOPES He-3**
magnetic properties of, in helium-4, 20: 44502 (COO-1198-382)
meson $(\mu^-)$ capture by, rate for partial, (T), 20: 44194
neutron reactions (n,p) with, spin dependence of, (E), 20: 44804
nuclear spin susceptibility, (E), 20: 44804
nuclear wave function for ground state of, orthonormal expansion of, (T), 20: 44692
photodisintegration, (T), 20: 44823
photon reactions at 12 to 170 Mev, nucleon angular distributions and energies from, (E), 20: 44711(T)
proton reactions (p,n) at 13.1 Mev, cross section for, (E), 20: 44786
reactions (He-3,$\alpha$) with carbon-12 at 8.5 to 10.0 Mev, (E/T), 20: 44728
reactions (He-3,d) with beryllium-9, carbon-13, and magnesium-25, (E), 20: 44601(R) (ANL-7218)
reactions (He-3,d) with iron-54, iron-56, nickel-58, and nickel-60 at 16.5 Mev, (E), 20: 44837
reactions (He-3,d) with argon-36, potassium-37 energy levels from, (E), 20: 44838
reactions (He-3,He-6) with calcium-40, calcium-37 mass from, (E), 20: 44659 (UCRL-16990)
reactions (He-3,n) with boron-11, nitrogen-13 energy levels from, (E), 20: 44775
reactions (He-3,p) with boron-11 at 1.23 Mev, carbon-13 energy levels from, (E), 20: 44775

scattering by carbon-12 at 8.5 to 10.0 Mev, elastic, (E/T), 20: 44728
specific heat of liquid, determination of, 20: 44516(T)
use in high pressure gas scintillation detectors for gammas and neutrons, 20: 43733

**HELIUM ISOTOPES He-4**
content in solar flares, 20: 44104
deuteron elastic scattering at 18 to 22 Mev, angular distributions using polarized deuterons, (E), 20: 44750
energy levels of liquid, variational method for studying ground, 20: 44491
energy levels of, supermultiplet of negative-parity, (T), 20: 44755
magnetic properties of dilute solutions of helium-3 in, 20: 44502 (COO-1198-382)
neutron elastic scattering at 12.0 and 16.2 Mev, using polarized neutrons, (E), 20: 44732
thermal capacity of hcp, theory for, 20: 44527
transitions between excited states, radioastronomical detection, 20: 44081
use in age estimations for Pleistocene events, 20: 43557

**HELIUM ISOTOPES He-8**
half life from photoproduction on boron-11 at 250 Mev, (E), 20: 44726
production in meson $(\pi^-)$ reactions at 3.5 Bev/c in nuclear emulsions, (E), 20: 44747
production in meson $(\pi^-)$ capture by carbon and oxygen, (E), 20: 44770

**HEMAGGLUTININS**
effects of phyto-, on cultured lymphocyte cells, 20: 43272(R) (RLO-581-10, pp 5-32)
immune reactions to phyto-, in adult and newborn rabbits and cultured lymphoma cells, 20: 43272(R) (RLO-581-10, pp 5-32)
properties and preparation of phyto-, 20: 43272(R) (RLO-581-10, pp 5-32)

**HEMATOLOGY**
abstracts on, 20: 42747(R) (UR-49-687, pp 148-76)

**HEMATOPOIETIC SYSTEM**
effect of 5-methoxytryptamine and cystamine on myelogram of irradiated mice, 20: 42938
effects of erythropoietin administration on mouse, effects of injection time on, 20: 42713(R) (UCRL-16246, pp 107-18)
lymphoid cell functions in, autoradiographic studies of, 20: 42784
physiology of leukocyte formation and regulation, 20: 42708(R) (TID-22931)
quantitative distribution of marrow in, 20: 43620
radiation effects on mammalian, x, 20: 42844 (BNL-10385)
radiation injuries to, in experimental animals following subcutaneous injection of radionuclides, 20: 42967
radiation injury and recovery of, 20: 42845 (CONF-660543-1)
radioprotective effective of DNA, RNA, and orotic acid on, in rabbits and rats, 20: 42937
radiosensitivity of mouse, effects of bacterial toxin and fractionated exposure on, 20: 42831 (AD-635600)
stem cells in, properties of, 20: 42705 (BNL-10405)

**HEMINS**
radioprotective activity of imidazole derivatives in, 20: 42979

**HEMOGLOBIN**
analysis of, techniques for, 20: 43014(R) (RLO-581-10, pp 33-6)
characteristics of fetal abnormal and old and young erythrocyte, 20: 43272(R) (RLO-581-10, pp 5-32)
radiation effects on binding of human, with malonaldehyde, 20: 42799(R) (UCB-34P95-1)
radiation effects on body content of, in man, beta and gamma, 20: 42908

**HEMOLYSIN**
radiation effects on synthesis in rabbits, effects of nucleic acid analogs on x, 20: 42835(R) (ANL-7136, pp 63-80)

**HEPTANE**
bis(2-ethylhexyl) phosphate–heptane, solvent properties for americium, 20: 43072(R) (IDO-14679, pp 193-229)
radiolysis of, at 77°K, hydrogen emission in, 20: 43312
solvent properties for fructose, glucose, and sucrose, 20: 43402

**HERBICIDES**
applications in weed control, tracer methods for study of, 20: 42742 (STI-PUB-113)
distribution of degradation products of, in plants and soil, tracer studies of, 20: 42742 (STI-PUB-113)

**HETEROGENEOUS REACTORS**
coolant kinetics of, research on water, 20: 43484(R) (STL-372-38)

**HEXANE**
effects on selectivity coefficients of monovalent cations for dinonylnaphthalenesulfonates, 20: 43447
radiolysis of, effects of perfluorocarbons on hydrogen yields in gamma, 20: 43316
solvent properties for fructose, glucose, and sucrose, 20: 43402

**2,5-HEXANEDIONE**
radiolysis of, correlation of structural unit with G values of products from gamma, 20: 43296

**HEXANETHIOLS**
radiolysis of, EPR studies of radicals from electron, 20: 43330

**1-HEXANOL**
solvent properties for fructose, glucose, and sucrose, 20: 43402

**HEXOSES**
radiation effects on levels of, in hyperthyroid rats, x, 20: 42805

**HIBERNATION**
radiosensitivity effects on ground squirrels, 20: 42835(R) (ANL-7136, pp 63-80)

**HIGH-ALTITUDE EXPLOSIONS**
radio-wave absorption by fission electrons from, 20: 44479

**HIGH ENERGY INJECTION DEVICES**
status and objectives of DCX-2, 20: 44865 (ORNL-4011)

**HIGH-PRESSURE SYSTEMS**
design for neutron diffractometry, 20: 43473(T)

**HIGH TEMPERATURE GAS COOLED REACTOR EXPERIMENT**
development and operation, Apr. 1965 to Mar. 1966, 20: 45114(R) (NP-16272)

**HIGH-TEMPERATURE REACTIONS**
bibliography on, 20: 43903 (NP-16238)

**HIGH TEMPERATURE SEPARATION PROCESSES**
development of, for liquid metals, 20: 43819

**HIPPURIC ACID, *o*-IODO-, SODIUM SALTS**
labeling with iodine-131, 20: 43397
labeling with iodine-131, 20: 43403
preparation of iodine-131-labeled, 20: 43388

**HIROSHIMA**
disease occurrence and mortality patterns of survivors of atomic disaster in, 20: 42697 (ABCC-18-65)
psychotic syndromes in atomic bomb survivors in, 20: 42924
radiation effects on health of population of, 20: 42827(R) (ABCC-58-59)
radiation effects on health of population of, 20: 42828(R) (ABCC-59-60)

**HISTAMINE**
content in guinea pig blood after injection of cysteamine, 20: 42982

**HISTIDINE**
acceptance by t-RNA, effects of horseradish peroxidase, 20: 42809
glycyl-L-, spectra of deuterated imidazole group in, PMR, 20: 43281
polymers of, spectra of deuterated imidazole group in, PMR, 20: 43281
spectra of deuterated imidazole group in, PMR, 20: 43281

**HISTOLOGY**
of blood vessels in irradiated rabbit brain, 20: 42862
radiation effects on rat testes, x, 20: 42961
use in diagnosis of dysembryoma and seminoma of testis, 20: 43034

**HOLMIUM**
determination of, effects of metal ions on spectrophotometric, 20: 43100
ionization potentials of, electron-impact method for measuring, 20: 43235
magnetization of polycrystalline, frequency dependence of, (E), 20: 44992 (IS-T-108)

**HOLMIUM ALLOYS**
Al–Ho, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Ho, crystal structure of intermetallic compound, 20: 43920
Ho–Mn, crystal structure of intermetallic compound, 20: 43918

**HOLMIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

**HOLMIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with glycolic and lactic acids, thermodynamic properties of, 20: 43215

**HOLMIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221

**HOLMIUM ISOTOPES Ho-165**
gamma elastic scattering at 12.6 and 16.4 Mev, (E), 20: 44710
gamma reactions (γ,n) and (γ,2N) from threshold to 196 Mev, (E), 20: 44710
gyromagnetic ratios, (E/T), 20: 44791
nuclear deformation, (E), 20: 44710

**HOLMIUM PERRHENATES**
preparation and properties of, 20: 43217

**HOLMIUM SYSTEMS**
graphite–Ho, preparation and properties of intercalation compounds in, (E), 20: 44999

**HORMONES**
radiation effects on thyroid, x, 20: 43029

**HOSPITALS**
radiation monitoring of radiology departments and radioisotope laboratories of, in New Zealand, 20: 43581(R) (NP-16245)
use of radioisotopes, waste disposal and protective measures, 20: 42796

**HYDRAZINE**

production of, development and economics of chemonuclear processes for, 20: 43300

**HYDRAZYL, DIPHENYLPICRYL-**

effects on radioinduced polymerization of styrene, 20: 43338

**HYDRIODIC ACID**

sorption of vapors of, coating development for, 20: 45045(R) (BMI-X-10173)

**HYDROAROMATIC COMPOUNDS**

development of radiation-resistant, 20: 43493

**HYDROBROMIC ACID**

radioinduced addition of, to ethylene and propylene in liquid phase, gamma, 20: 43298

**HYDROCARBONS**

determination in reactor containment buildings, equipment for, 20: 43068(R) (IDO-14679, pp 47-50)

development of radiation-resistant, 20: 43493

photolysis of, chromatography equipment and method for analyzing products in UV, 20: 43288(R) (CALT-532-1)

radioinduced carboxylation of, gamma and x, 20: 43333

radioinduced production in meats, 20: 42973

yields in radiolysis of ethyltoluene isomers, effects of dose, scavenger, and temperature on, 20: 43359

**HYDROCHLORIC ACID**

centrifugal stretching constant in, finite nuclear mass effects on, (T), 20: 44123

reactions with scandium oxide, product formation in, 20: 43259

use for decladding irradiated reactor fuels, problems in, 20: 43413 (EURAEC-1659)

use in preparation of single crystals of tungsten oxide by chemical transport, 20: 43257

**HYDROCYANIC ACID**

production of, development and economics of chemonuclear processes for, 20: 43300

**HYDROFLUORIC ACID**

reaction with beryllium, heat of formation of beryllium fluoride from, 20: 43269

reactions with uranium dioxide to form uranium tetrafluoride, 20: 43198

reactions with uranium dioxide, estimation of yields from, 20: 43201

$Al(NO_3)_3$–HF–$HNO_3$, effects on dissolution of aluminum-canned irradiated thorium dioxide, 20: 43412 (DP-1044)

**HYDROFLUORINATION**

equipment design, instrumentation, and techniques for fluid-bed, of uranium, 20: 43200

fluid-bed method for, for uranium dioxide, 20: 43198

**HYDROGEN**

abstraction by hot tritium atoms in the methane–tritium system, theoretical treatment of, 20: 43408

atomic density measurements in afterglow plasma of, 20: 44852 (AD-629924)

compatibility with niobium and tantalum and their alloys in presence of thermal gradient, 20: 43832 (NASA-TN-D-3546)

Coulomb potential of atomic, multidimensional, 20: 44150

determination in reactor blanket gas, design of continuously operating gas chromatogram for, 20: 43157

diffusion in palladium and palladium alloys, measurement of, 20: 43934

diffusion in palladium and palladium–silver alloys, effects of pressure and temperature on, 20: 43935

dissociation by electron impact, total cross section for, 20: 43288(R) (CALT-532-1)

electron density and temperature of plasma of, in spindle cusp, 20: 44860 (JUL-352-PP)

electron pair correlation energies for atomic and molecular, 20: 44132

exchange with deuterium in palladium, effects of temperature and pressure on, 20: 43236

exchange with deuterium on tungsten, at 77 to 473°K, desorption spectra studies of, 20: 43255

fission fragment energy-losses in, (E), 20: 44685

interactions with hydrogen atoms and nitrogen molecules, cross sections for, 20: 44146

ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122

isotopic exchange with deuterium over palladium hydride, at –195 to –183°C, 20: 43232

neutron capture by, gamma ray energy from, 20: 45046(R) (IDO-17192)

neutron scattering by ortho- and para-, thermal, (T), 20: 44591

oscillations in para, effect of forced convection heating on thermal-acoustic, 20: 43480 (LA-3543)

proton radiation effects at 30 kev on molecular, luminescence emission, 20: 44035

proton reactions with, cross sections for double electron capture by 2- to 50-kev, (E), 20: 44140

radio wave emission from plasma of, thermal, (T), 20: 44883

reactions with rare earth chlorides, thermodynamics of, 20: 43222

separation from deuterium on palladium, effects of pressure and temperature on, 20: 43236

sorption by gamma-irradiated quartz, 20: 43302

sorption by palladium hydride at –195 to –183°C, 20: 43232

sorption by zeolites at low pressures and temperatures, 20: 43499

spectra in ether solutions of alkyllithium and lithium tetraalkylmetalate compounds, NMR, 20: 43392

spectra in ether solutions of methyllithium with dimethylmagnesium or dimethylzinc, NMR, 20: 43393

temperature of neutral atoms of, in C-stellarator discharges, (E), 20: 44911

yields during radiolysis of heptane, 20: 43312

yields from gamma radiolysis of furan and tetrahydrofuran, 20: 43295

yields from irradiation of polyethylene terephthalate, 20: 43378

yields from radiolysis of aqueous solutions of cyclohexane, effects of copper sulfate and air on, 20: 43357

yields in gamma radiolysis of aqueous organic solutions, effects of nitrate ion content on primary, 20: 43351

yields in radiolysis of aqueous solutions, effects of deuterium on, 20: 43352

yields in radiolysis of trivalent plutonium solutions, 20: 43358

yields in radiolysis of ethyltoluene isomers, effects of dose, scavenger, and temperature on, 20: 43359

yields in x radiolysis of ethyl mercaptan, 20: 43320

**HYDROGEN ION CONCENTRATION**

determination in solutions, titrimetric, 20: 43071 (IDO-14679, pp 75-191)

effects on autoxidation of oxyhemoglobins and oxymyoglobins, 20: 42799(R) (UCB-34P95-1)

effects on viscosity of gamma-irradiated polyamino acid solutions, 20: 42826

**HYDROGEN IONS**

effects on glass surfaces up to 30 kev, 20: 45017

energy in ionosphere, thermal conduction effects on, 20: 44430

production of negative, modification of proton sources of U-120 cyclotrons for, 20: 44056

reactions with helium at 4.5 to 60 kev, cross sections for, (E), 20: 44138

sputtering on stainless steel, analysis of, 20: 44131

**HYDROGEN ISOTOPES**

content variations in lithium deuteride, falling drop density method for determining, 20: 43089 (Y-1175(Del.))

**HYDROGEN PEROXIDES**

decomposition on irradiated, thermally annealed, and unirradiated rare earth and transition metal oxides, kinetics of catalytic, 20: 43364

effects of endogenous, on weight of tumor-bearing mice, 20: 42840(R) (ANL-7136, pp 164-90)

effects on deposition of thallium on copper, 20: 43400

effects on preparation of iodine-131-labeled hippuran, 20: 43403

formation in radiolysis of cyclohexane in air, 20: 43357

production of, development and economics of chemonuclear processes for, 20: 43300

reactions with plutonium ions, kinetics of, 20: 43245

yields in radiolysis of trivalent plutonium solutions, 20: 43358

**HYDROGEN SULFIDES**

photolysis of normal and deuterated, at 77°K, ESR spectral studies of, 20: 43196

**HYDROGEN SYSTEMS**

DBr–H, photolysis of, energy threshold and reaction cross section for uv, 20: 43289 (CALT-532-2)

DI–H, photolysis of, cross section and threshold energy calculations for, 20: 43288(R) (CALT-532-1)

DI–H, photolysis of, energy threshold and reaction cross section for uv, 20: 43289 (CALT-532-2)

**HYDROGENATION**

equipment for, regeneration of decomposed gas-oil coolants by, 20: 43271 (IAE-1066)

**HYDROLOGY**

radioisotopes in, survey of, 20: 43555

**HYDROMAGNETIC WAVES**

propagation in collisionless plasma, effect of finite ion Larmor radius on, (T), 20: 44952

propagation in compressible perfect fluid of infinite conductivity, relativistic, 20: 44409

propagation in ionosphere during solar eclipse, 20: 44432

propagation in magnetosphere, theory for group, 20: 44469

propagation in magnetosphere, detection of, 20: 44431

propagation in transverse magnetic fields, (T), 20: 44941

structure of Alfvén shock, (T), 20: 44414

**HYGROMETERS**

catalog of Russian radiometric, 20: 43639(T) (AEC-tr-6633)

theory of neutron, 20: 43558

**HYPERFINE STRUCTURE**

use in determining nuclear magnetic moments, comparison with nuclear induction method, 20: 44695

**HYPERFRAGMENTS**
decay of ${}_{\Lambda}H^4$, leptonic, (T), 20: 44803
decay of, nonmesonic, (T), 20: 44760
hyperon (Λ) binding energies in, (T), 20: 44702

**HYPERONS**
decay of, quark model for nonleptonic, 20: 44199

**HYPERONS (Λ)**
binding energies in hypernuclei, (T), 20: 44702
binding energies in hypernuclei, (T), 20: 44703

**HYPERONS ($\Lambda^0$)**
decay of, evidence of time reversal in, 20: 44193

**HYPERONS ($\Omega^-$)**
decay of, covariant field theory of $\Xi^0 + l^- + \bar{\nu}$, 20: 44217

**HYPERONS ($\Sigma^-$)**
production in mesons (K⁻) capture by emulsion nuclei, (E), 20: 44657 (UCRL-16602)

**HYPERONS ($\Sigma^0$)**
decay of, test of time-reversal invariance in $\Lambda^0 e^+ e^-$, (E), 20: 44251

**HYPERONS ($\Sigma^+$)**
production in mesons (K⁻) capture by emulsion nuclei, (E), 20: 44657 (UCRL-16602)

**HYPERONS ($\Xi^0$)**
decay of, evidence of time reversal in, 20: 44193

**HYPERTHYROIDISM**
effects on x radiation effects on glycoprotein and hexose content in rat blood serum, 20: 42805
radiotherapy using iodine, subsequent exophthalmos from, 20: 42946

**HYPOTHYROIDISM**
iodoamino acids of patients with, distribution of iodine-127 and -131 in, 20: 42774

## I

**ICE**
radiation effects on, EPR spectra of gamma, 20: 43290 (COO-1528-7)

**ICELAND**
radioactivity of biota and humans of, 20: 43005

**IGNEOUS ROCKS**
potash content of, of Bagdad, Arizona, 20: 43507(R) (COO-689-60, App.A-7)

**ILLINOIS**
fallout monitoring in Chicago area, 1965, 20: 43512(R) (ANL-7136, pp 315-27)

**ILLITES**
sorptive properties for cesium, 20: 43455

**4-IMIDAZOLINE-2-THIONE, 1-*p*-ETHOXYPHENYL-4-D-*arabo*-TETRAHYDROXYBUTYL-**
radioprotective properties of, at cellular, molecular, and subcellular levels, 20: 42979

**4-IMIDAZOLINE-2-THIONE, 1-PHENYL-4,5-D-*gluco*-PYRANYL-**
radioprotective properties of, at cellular, molecular, and subcellular levels, 20: 42979

**IMMUNE REACTIONS**
effects of grafting fetal liver cells in mice with radioinduced leukemia, 20: 42893
effects of mercamine on bactericidal activity of irradiated blood serum, 20: 43003
effects on metabolism in mouse radiation chimeras given bone marrow injections, 20: 42854(R) (TID-23127)
measurement of, in rabbits and rats, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects in dogs and man, extra-corporeal blood exposure, γ, 20: 43013(R) (ORO-2459-1)
radiation effects on, in rabbits, x, 20: 42855(R) (TID-23203)
radiation effects on rabbit, x, 20: 42830 (AD-635598)
radiation effects on, of guinea pigs to toxin, 20: 42878
radiation effects on production of diphtheria and tetanus antibodies, x, 20: 42887
radiation effects on mouse tumor transplant, x, 20: 42889
radiation effects on development of auto-, following x radiotherapy, 20: 43027
use of x radiation and drugs to control, following human kidney transplants, 20: 43032

**IN-PILE LOOPS**
development of supercritical water-cooled, for fuel element testing, 20: 45098(R) (WCAP-3374-4)

**INCONEL**
corrosion in oxidizing atmospheres at high temperatures, 20: 43842
radiation effects on type 625, neutron, 20: 45106(R) (ANL-7249)
radiation effects on type 600, in-reactor, 20: 44027

**INCONEL X**
radiation effects on mechanical properties of, neutron, 20: 44013

**INDIA**
fallout monitoring in water and milk in Bombay, 1964 to 1965, 20: 43532
radioactivity of sand from Solani River near Roorkee, 20: 43533

**INDIAN OCEAN**
strontium-90 content of, evaluation of total, 20: 43517(T) (AEC-tr-6798, Paper 2)
strontium-90 distribution on surface of, compared to Atlantic and Pacific Oceans, 20: 43516(T) (AEC-tr-6798, Paper 1)

**INDIUM**
electric conductivity of thin films of, charge effects on, 20: 44510
electron-phonon coupling in single-crystal, transverse, 20: 44553
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
superconducting transition temperatures of, crystallite size effects on, 20: 44552

**INDIUM ALLOYS**
In–Pb, superconducting transition temperatures of, 20: 44515
In–Tl, superconducting critical current in, effects of field orientation on, 20: 44560

**INDIUM ISOTOPES In-109**
gamma spectra, 20: 44634(R) (IDO-17188)

**INDIUM ISOTOPES In-111**
gamma spectra, 20: 44634(R) (IDO-17188)

**INDIUM ISOTOPES In-114**
incorporation in tetrahydrated ammonium thallium sulfates, mixed crystal formation in, 20: 43252

**INDIUM ISOTOPES In-115**
neutron capture cross section discrepancies for, explanation by boron (n,α) cross sections in flux monitoring, 20: 44611 (CONF-660303, pp 486-501)
proton reactions (p,n) at 8 to 14 Mev, neutron spectra from, (E), 20: 44739

**INDIUM ISOTOPES In-116**
gamma spectra, 20: 44634(R) (IDO-17188)

**INDOLE,3-(2-AMINOETHYL)-**
radioprotective effects on mice and rats, reaction mechanisms for, 20: 42998(R) (EUR-2992.f)

**INDOLE, 3-(2-AMINOETHYL)-5-METHOXY-**
effect on hematopoietic cells of irradiated mice, 20: 42938
effects on acceleration tolerance in mice and guinea pigs of 5-methoxy, (E), 20: 43004

**5-INDOLOL, 3-(2-AMINOETHYL)-**
effects on acceleration tolerance in mice and guinea pigs, 20: 43004
effects on radioinduced hemostasis in rat mesentery microcirculation, 20: 42978
protective effects against γ and protons in mice, 20: 43002
protective effects of sodium amytal in rats, correlation with effects on oxygen content of spleen, 20: 43008
radioprotective effects of, on survival time in mice, x, 20: 42991

**INDUSTRIAL HYGIENE**
monitoring of atmosphere in uranium mines, 20: 43594(T) (AEC-tr-6763)
practice in beryllium plants, 20: 42751
practice in beryllium plants, 20: 42752
practice in beryllium plants, 20: 42755
practice in beryllium plants, 20: 42756
practice in beryllium plants, cost factors, 20: 43628

**INDUSTRIAL MANAGEMENT**
motivation and human error in, control of, 20: 45241 (SC-TM-65-135)

**INFECTIONS**
control and pathology of viral, in domestic animals, 20: 42954
diagnosis, control, and pathology of bacterial, in laboratory mice, 20: 42699(R) (ANL-7136, pp 94-108)
effects of preinfection with irradiated cercariae on course of Schistosoma, in mice, 20: 42947
etiology of endogenous, during radiation sickness, 20: 43052

**INFLAMMATION**
diagnosis of beryllium pneumonitis, 20: 42751
pathology of beryllium pneumonitis, 20: 42752
pathology of beryllium pneumonitis in man, 20: 42753
pathology of beryllium pneumonitis, 20: 42754
therapy of radioinduced intestinal, 20: 42994

**INFORMATION CENTERS**
bulletin of IAEA nuclear data, 20: 44665(T) (INDSWG-101)

**INFRARED RADIATION**
effects on frequency of x-ray-induced chromosome aberrations in cultured kidney cells, 20: 42837(R) (ANL-7136, pp 124-40)
effects on thymidine metabolism in cultured kidney cells, tracer study, 20: 42837(R) (ANL-7136, pp 124-40)
induction of hyperthermia in rats, radiosensitivity studies, 20: 42959

**INFRARED SPECTROSCOPY**
absorption cells for, fabrication and calibration of liquid, 20: 43178 (NRL-6394)

**INSECTICIDES**
labeling of Malathion and Parathion with phosphorus-32, 20: 43397
use for control of insect infestation of stored fruit and vegetables,

20: 43780

**INSECTS**
biology of *Ceratis capita, Dermatobia hominis,* and *Leucaptera coffeela,* 20: 42850(R) (NYO-2043-130)
radiation and conventional control of, infesting stored fruits and vegetables, 20: 43780
radiation control of fruit flies, *Dacus oleae* and *Ceratitis capitata,* 20: 42847(R) (NP-16176)
radiation control of grain-infesting, determination of minimum lethal dose for γ, 20: 42904
radiation control of, infesting dried or smoked fish, 20: 43777
radiation control of, infesting dried or smoked fish, 20: 43778
radiation effects on reproduction of *Ceratis capita, Dermatobia hominis,* and *Leucaptera coffeella,* γ, 20: 42850(R) (NYO-2043-130)
radiation effects on development of gonads of fruit flies, *Dacus oleae* and *Ceratitis capitata,* γ and x, 20: 42847(R) (NP-16176)
radiation effects on acetylcholine content in eggs and pupae of *Bombyx mori* and *Celerio euphorbial,* γ, 20: 42874
radiation effects on mortality and reproductive behavior of *Ips confusus,* γ, 20: 42883
radiation effects on, lethal α, β, γ, and x, 20: 42934
radioinduced mutations in *Ephestia kuehniella,* effects of developmental stage on spectra of x, 20: 42970
radioinduced sterility in grain-infesting, γ, 20: 42904
radiosensitivity of eyes of moth, β and visible light, 20: 42852(R) (ORO-2903-28)
radiosensitivity of various developmental stages of Dermestes and Necrobia infesting dried or smoked fish, γ, 20: 43778
role of fleas, in transfer of *Pasteurella pestis* in plague epidemics, 20: 43587 (RM-4968-TAB)
sterilization of screw-worm flies, effectiveness of chemosterilants compared with γ radiosterilization, 20: 42724

**INSTRUMENTATION**
conference on, for power generating equipment, 20: 43665
design to use crossed molecular beams in reaction dynamics, 20: 44109 (CALT-532-3)
modules for nuclear, standard, 20: 43664

**INSTRUMENTS**
book: *Handbook of Automatic Control Instruments with Isotope Sources,* 20: 43639(T) (AEC-tr-6633)
modules for nuclear standard, 20: 43664

**INSULIN**
radiation effects on distribution in rats, x, 20: 42932
radioinactivation of, labeled with or in presence of iodine-131, 20: 42760
radioinactivation of iodine-labeled, variations with degree of iodination, method of labeling, and specific activity, 20: 42761

**INTERMETALLIC COMPOUNDS**
precipitation in uranium with 630 ppm aluminum and 250 ppm iron, 20: 43958
properties of aluminum–rare earth, tabulation of, 20: 43972

**INTERNAL CONVERSION**
coefficients for K- and L-shell, tables of, 20: 44664(T) (BNL-tr-65)

**INTESTINE**
cesium-137 absorption in rat, inhibitory effects of ferric cyanoferrate, 20: 42786
histamine content in blood from guinea pig, following cysteamine injection, 20: 42982
obstruction of rat, effects of antibiotics and bile on, 20: 42835(R) (ANL-7136, pp 63-80)
origin and treatment of radioinduced diarrhea, 20: 42994
radiation effects on reactivity of rat, to parasympathomimetic substances, 20: 42964
radiation effects on acetylcholine esterase activity in rat, 20: 42964
radiation effects on carbon-14-labeled alanine absorption by rabbit, 20: 42972
radiation effects on microcirculation of rat mesentery, response to serotonin following x, 20: 42978
transit time of ceramic spheres containing manganese-54 or uranium carbide particles in, of animals and man, 20: 42740 (LA-DC-7764)
uptake and distribution of deuterium oxide in mesentery, mucosa, muscle, and submucosa of dog, *in vitro,* compartmental analysis of, 20: 42748
uptake of iron-59 in x irradiated rats, 20: 42957

**INVERTEBRATES**
ecology of Eastern Mediterranean Sea, 20: 43508(R) (NP-16179)

**IODATE IONS**
iodine-131 exchange between, and iodide ions, effects of chloride, iodide, nitrate, and sulfate ions on, 20: 43248

**IODIDE IONS**
desorption from silver, tracer studies of effects of electric fields, pressure, and temperature on, 20: 43250
effects on isotopic exchange between iodide and iodate ions, 20: 43248
iodine-131 exchange between, and iodate ions, effects of chloride, iodide, nitrate, and sulfate ions on, 20: 43248

**IODINE**
content in chondritic meteorites, 20: 44077
deposition of vapors of, on surfaces in reactor systems, 20: 45045(R) (BMI-X-10173)
deposition of, use of composite diffusion tubes to study, 20: 43582 (ORNL-3985)
determination in aqueous solutions, colorimetric, 20: 43069(R) (IDO-14679, pp 51-9)
determination in aqueous and carbon tetrachloride solutions, colorimetric, 20: 43071 (IDO-14679, pp 75-191)
determination in polypropylene dissolvers, method for, 20: 43069(R) (IDO-14679, pp 51-9)
effects of simulated altitude on rat metabolism of, 20: 42745(R) (UCRL-16246, pp 126-37)
reactions of recoil, with iodomethane above 10 ev, excitation function and yields in, 20: 43291 (IA-1096)
removal from air using foams, 20: 43585 (ORNL-TM-1589)
retention on adsorbers and filter materials, 20: 43067(R) (IDO-14679, pp 6-46)
separation from fission products, method for, 20: 43067(R) (IDO-14679, pp 6-46)
separation of thyroid fractions with ion exchange resins, 20: 43029
sorption by boron nitrides, 20: 43067(R) (IDO-14679, pp 6-46)
sorption of vapors of, coating development for, 20: 45045(R) (BMI-X-10173)
sorption of, charcoal filter for, 20: 43584 (ORNL-P-2411)

**IODINE IONS**
charged distribution of 10- to 70-Mev stripped, 20: 44136
detection of negative, design of scintillation detector for, 20: 43735

**IODINE ISOTOPES**
distribution in food chain of man, released during nuclear explosions, 20: 43574 (CONF-660538-1)
effects of radioactive, on insulin, variations with preparation method and specific activity, 20: 42761
fixation by muds, 20: 43544
release during nuclear explosions, bioenvironmental study, 20: 43574 (CONF-660538-1)
thyroid uptake of, calibration of equipment for measuring, 20: 43031

**IODINE ISOTOPES I-125**
uptake by rat serum and thyroid, effects of simulated altitude on, 20: 42745(R) (UCRL-16246, pp 126-37)
use in radiographic instruments for density measurements of bone and soft tissue, 20: 43049

**IODINE ISOTOPES I-127**
distribution in thyroidal iodoamino acids of euthyroid patients, 20: 42774
neutron capture cross section discrepancies for, explanation by boron (n,α) cross sections in flux monitoring, 20: 44611 (CONF-660303, pp 486-501)
uptake by rat serum and thyroid, effects of simulated altitude on, 20: 42745(R) (UCRL-16246, pp 126-37)

**IODINE ISOTOPES I-129**
abundance of, terrestrial and meteoritic, 20: 43550(R) (NYO-844-67)

**IODINE ISOTOPES I-131**
analysis of carrier-free, by paper electrophoresis, 20: 43126
content in human bones and tissues, 20: 43626
content in milk after uptake by cows from hay, 20: 43576 (CONF-660621-7)
content in nuclear debris over Sweden, 1962 to 1963, 20: 43524
deposition of albumin-incorporated, following inhalation in man, 20: 42797
distribution in thyroidal iodoamino acids of euthyroid patients, 20: 42774
effects of ethiodol-incorporated, on human lymph system following cancer therapy, 20: 42976
effects on duration of physiologic activity of insulin, 20: 42760
effects on human and rat thyroids, 20: 42857(R) (TID-23228)
exchange between iodate and iodide ions, effects of chloride, iodide, nitrate, and sulfate ions on, 20: 43248
incorporation in diagnostic compounds, 20: 43397
incorporation in hippuran, 20: 43403
incorporation in Rose Bengal, by ion exchange, 20: 43386
intake in food, methods for estimating, 20: 43573 (CONF-765-13)
metabolism of triolein-incorporated, in man as affected by age, 20: 42782
monitoring environmental, at BNL, 20: 43608
preparation of iodine-131-labeled, 20: 43388
preparation of protein-incorporated, using chloramine T, 20: 43274
production of, by neutron irradiation of telluric acid, 20: 43404
production of, review of methods for, 20: 43399
radiation dose to gastrointestinal tract from ingested, calculation of, 20: 43043

release to biosphere from nuclear explosions, hazards from, 20: 43574 (CONF-660538-1)
removal of, from rat skin by ultrasonics, 20: 42811
use in radiodiagnosis, 20: 42796
use in radiotherapy, 20: 42796
use in therapy of hyperthyroidism, exophthalmos from, 20: 42946

**IODINE ISOTOPES I-132**
release to biosphere from nuclear explosions, hazards from, 20: 43574 (CONF-660538-1)

**IODINE ISOTOPES I-133**
content in milk after uptake by cows from hay, 20: 43576 (CONF-660621-7)
release to biosphere from nuclear explosions, hazards from, 20: 43574 (CONF-660538-1)

**IODINE ISOTOPES I-134**
release to biosphere from nuclear explosions, hazards from, 20: 43574 (CONF-660538-1)

**IODINE ISOTOPES I-135**
release to biosphere from nuclear explosions, hazards from, 20: 43574 (CONF-660538-1)

**ION BEAMS**
effects on gain of electron multiplier tubes, (E), 20: 43659
production and acceleration of, electrostatic generator design for, 20: 44068(P)

**ION EXCHANGE**
method for separating strontium-90 from milk, 20: 43537

**ION EXCHANGE MATERIALS**
preparation of, using radiation, 20: 43311
properties of triisoöctylamine, for rare earths, effects of diluent on, 20: 43439
sorption capacity of zeolites at low pressures and temperatures, 20: 43499

**ION SOURCES**
construction of low-voltage capillary, 20: 44119
design of Pierce-electrode type, 20: 44922
duoplasmatron, electron energy dependence on pressure in, 20: 44921

**IONIZATION**
in daytime F-layer, photoionization as source of, 20: 44467

**IONIZATION CHAMBERS**
design and performance of, with silver electrodes, 20: 43680
design and performance of, for reactor use, 20: 43716
design and performance for cosmic-ray ionization measurements at sea level, 20: 44456
design of, for measuring activity of radioactive gases, 20: 43106
use in neutron dosimetry, 20: 43671 (ORNL-P-2467)

**IONOSPHERE**
acoustic-gravity waves in, from nuclear detonation, 20: 44448
composition at 100 to 200 km, (T), 20: 44462
composition of, mass spectrometer for determining, 20: 43648
disturbances in E and F region of, correlation with solar indices, (E/T), 20: 44435
disturbances in F region from auroral-generated atmospheric waves, (E), 20: 44437
disturbances in F1 layer of, magnetic effects on drift and anisotropy of, (E), 20: 44440
electric current effect on low-latitude disturbance daily variation, (E), 20: 44444
electric currents in, effects on N-S asymmetry of $S_q$, (E/T), 20: 44438
electron and ion temperatures in, thermal conduction effects on, 20: 44430
electron content at temperate latitudes of, during declining phase of sunspot cycle, (E/T), 20: 44449
electron density at sunspot minimum in F2 layer of, (E/T), 20: 44433
electron density decrease in F region of, following passage of powered rocket, (E), 20: 44459
electron density enhancement in F2 region of, night-time abnormal, 20: 44473
electron density in F2 region, (T), 20: 44474
electron density in, gyro-plasma probe measurement of, 20: 44476
electron density irregularities in, diurnal variation of, (E), 20: 44450
F-layer formation in, photoionization in, (T), 20: 44467
geomagnetic field, nonsymmetric inflation by ionized gas of, (T), 20: 44443
geomagnetic storm effects on F region of, 20: 44477
geomagnetically trapped particle shells in, model for, 20: 44416 (AD-639436)
hydromagnetic wave propagation in, during solar eclipse, 20: 44432
ion density and temperature in, retarding potential analyzers for measuring, 20: 44457
ion displacement in, effect of superimposed electric field on heavy, (T), 20: 44434
ion recombination in lower, 20: 44464
ionization at sunspot minimum in F2 layer of, processes that control, (E/T), 20: 44433
magnetic field variations in sporadic-E layers of, (T), 20: 44468
nitric oxide concentration in D region of, electron density for determining, (E/T), 20: 44436
radio wave propagation in, transmission curves to interpret backscattering echos of, 20: 44428
radio wave scattering in, cosmic particle fallout effects on, 20: 44157
radio-wave absorption in, cosmic noise method for, (E/T), 20: 44478
radio-wave absorption in, during solar eclipse, 20: 44426
radio-wave absorption in, during solar eclipse, 20: 44427
radio-wave propagation in, effects of high-altitude nuclear explosion on, 20: 44479
sporadic E layer in, at night, 20: 44470
sporadic-E layer correlation with winds, 20: 44447
spread F at equatorial latitudes, topside and bottomside behavior, 20: 44446
winds measured by gun-launched projectiles, 20: 44447

**IONS**
book: *Electron and Ion Processes in Solids*, 20: 43265
charge of, ion thin-down track width in nuclear emulsion for determining, 20: 43706
content in ionosphere at 100 to 200 km, (T), 20: 44462
content in mesosphere and stratosphere, (E), 20: 44463
density and temperature in ionosphere, retarding potential analyzers for measuring, 20: 44457
density, temperature, and velocity of positive, in solar wind, (E), 20: 44078
detection of negative, design of scintillation detector for, 20: 43735
effects of finite Larmor radius of, on hydromagnetic wave propagation in collisionless plasma, (T), 20: 44952
effects on silicon, channeling pattern formation in, 20: 45022
electron impact ionization cross sections, (T), 20: 44871(T) (CONF-660332-1)
electron reactions with, empirical formula for ionization cross sections for, 20: 44110 (IPP-1/50)
emission from electromagnetically trapped plasma, energy of recharged, 20: 44976
energy in ionosphere, thermal conduction effects on, 20: 44430
interactions in crystal lattices, directional effects during, (T), 20: 44991 (BNL-10544)
radiation effects on number of free, in rat muscle tissue, gamma, 20: 42929
recombination in lower ionosphere, 20: 44464
rotation in magnetic fields, spectral line splitting from, (T), 20: 44967
sputtering on metals, neutral particle energies from, 20: 44139

**IPRONIAZID**
radioprotective effects of, on survival time in mice, x, 20: 42991

**IRIDIUM**
determination in aluminum, spectrochemical, 20: 43068(R) (IDO-14679, pp 47-50)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439

**IRIDIUM ALLOYS**
Bi–Ir, superconductivity, 20: 44554

**IRIDIUM COMPLEXES**
chloropentammine, radiation effects on, from chemical reactions of recoil atoms, neutron, 20: 43340

**IRIDIUM ISOTOPES Ir-186**
nuclear data sheets, 20: 44713

**IRIDIUM ISOTOPES Ir-188**
nuclear data sheets, 20: 44715

**IRIDIUM ISOTOPES Ir-189**
nuclear data sheets, 20: 44716

**IRIDIUM ISOTOPES Ir-192**
decay of, osmium-192 and platinum-192 energy levels from, (E), 20: 44700
production of, developments in commercial, 20: 43803
reactions of recoil, formed by neutron irradiation of chloropentammine-iridium chloride, 20: 43340

**IRISH SEA**
radioactive effluent discharge from Windscale into, low-activity, 20: 45229

**IRON**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in boron by x-ray fluorescence, 20: 43091 (UCRL-14879)
determination in elements using 1,10-phenanthroline, colorimetric, 20: 43067(R) (IDO-14679, pp 6-46)
determination in niobium and tantalum by atomic absorption spectrophotometry, 20: 43162
determination in presence of silicon, use of lithium-drifted germanium detector for, 20: 43081 (ORO-2980-13)
determination in plant materials, activation, 20: 43060 (CEA-R-2967)
determination in powder samples by spectrographic methods, semi-

quantitative, 20: 43104

determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)

determination of trace amounts of, in tungsten and molybdenum by atomic absorption spectrophotometry, 20: 43154

determination using 1,10-phenanthroline, colorimetric, 20: 43071 (IDO-14679, pp 75-191)

effects on determination of radium-228 by ion exchange and actinium-228 counting, 20: 43442

effects on intermediate-temperature properties of zirconium beryllides, 20: 43886(R) (BBC-111)

neutron cross sections from 0.037 ev to 18 Mev, tables of, 20: 44661 (UNC-5139)

neutron inelastic scattering, 20: 44613 (CONF-660303, pp 577-98)

nuclear magnetic fields of antimony, copper, and yttrium in, (E), 20: 44824

proton reactions at 100 to 450 Mev, 20: 43550(R) (NYO-844-67)

proton total cross section at 17 Mev, (E), 20: 44662 (USC-136-111)

radiation effects on body content of, in cancer and non-cancer patients, beta and gamma, 20: 42908

radioinduced damage in, effects of annealing and carbon on neutron, 20: 44006

radioinduced defects in doped, neutron, (E), 20: 45039

radioinduced embrittlement and hardening in, effects of interstitial impurities on, neutron, 20: 44001

separation from hydrochloric acid solutions by solvent extraction using thenoyltrifluoroacetone and trioctylamine, 20: 43434

separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)

separation from other elements by ion exchange using triisoöctylamine, 20: 43439

separation of protactinium from, by sorption on activated charcoal, 20: 43148

separation of, from thorium in sulfuric acid solutions by ion exchange, 20: 43147

shielding properties of, against fallout, 20: 43568 (AD-636787)

strain aging, effect of stress on, 20: 43965

use of iron-57 enriched metallic, for calibrating Mössbauer spectrometers, 20: 43707

**IRON ALLOYS**

analysis for total carbon, gravimetric, 20: 43071 (IDO-14679, pp 75-191)

wear and corrosion testing as journal bearing material, 20: 43823 (AECL-2566)

Al–Cr–Fe, corrosion in oxidizing atmospheres at high temperature, 20: 43842

Al–Cr–Fe–Mo–Ti, properties of, effects of high-temperature thermomechanical treatment on, 20: 43961

Al–Fe–Mn–U, intermetallic compounds of, phase diagrams, 20: 43980

Co–Fe, alpha-to-gamma transformation temperatures, increase by additives, 20: 43815(R) (NASA-CR-54356)

Co–Fe–Ni, development of hardened martensitic, as high-temperature magnetic materials, 20: 43815(R) (NASA-CR-54356)

Fe–Ni, properties for coating metals, 20: 43880

Fe–Ni, radioinduced order-disorder transition in, neutron, 20: 44025

Fe–Ni–W, ductility and tensile properties of tungsten-base, 20: 43822

Fe–Ni–W, ductility and strength of sintered composite, effects of tungsten content on, 20: 43885 (ASRL-TR-132-2)

Fe–Pu, density and viscosity of liquid, 20: 43889 (CONF-660606-39)

Fe–Re, atomic ordering in sigma phase, 20: 43890 (COO-1198-385)

Fe–U, combustion kinetics of, 20: 43612

**IRON CITRATES**

use of iron-59-labeled, for erythropoiesis studies in polycythemia patients, 20: 43015(R) (UCRL-16246, pp 1-18)

use of iron-59-labeled, for erythropoietin stimulation studies, 20: 42713(R) (UCRL-16246, pp 107-18)

**IRON COMPOUNDS**

effects of injections on protein fractions in serum of irradiated rabbits, 20: 42870

**IRON FERROCYANIDES**

effects on excretion of cesium-137 in rats, 20: 42786

**IRON(III) HYDROXIDES**

properties as carrier for actinium-228, 20: 43442

**IRON IONS**

determination of divalent, in sulfate solutions using cerium sulfate and ferroin, titrimetric, 20: 43144

effects on cobalt determination in steel, 20: 43145

effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100

**IRON ISOTOPES Fe-52**

gamma spectra, 20: 44634(R) (IDO-17188)

**IRON ISOTOPES Fe-54**

energy levels from scattering, vibrational, (E/T), 20: 44795

helium-3 reactions (He-3,d) at 16.5 Mev, cobalt-55 energy levels from, (E), 20: 44837

neutron inelastic scattering at 2.5 Mev, gamma angular distribution from, (E), 20: 44813

**IRON ISOTOPES Fe-55**

energy levels from iron-57 (p,t) reactions, (E), 20: 44756

incorporation in tetrahydrated ammonium thallium sulfates, mixed crystal formation in, 20: 43252

preparation of high-specific-activity, 20: 43398

preparation of, for use as x-ray source, 20: 43384

**IRON ISOTOPES Fe-56**

energy levels from scattering, vibrational, (E/T), 20: 44795

helium-3 reactions (He-3,d) at 16.5 Mev, cobalt-57 energy levels from, (E), 20: 44837

neutron capture at 14 Mev, gamma spectrometer for measuring spectra from, 20: 43708

neutron capture cross sections for, effects of $(n,\gamma n')$ reaction on, (T), 20: 44614 (CONF-660303, pp 613-22)

neutron inelastic scattering at 2.5 Mev, gamma angular distribution from, (E), 20: 44813

**IRON ISOTOPES Fe-57**

magnetic hyperfine structure of impurity, in cobalt-57, (E), 20: 45033

proton reactions (p,t) at 40 Mev, $L = 0$ transitions in, (E), 20: 44756

use for calibrating Mössbauer spectrometers, 20: 43707

**IRON ISOTOPES Fe-58**

energy levels from scattering, vibrational, (E/T), 20: 44795

**IRON ISOTOPES Fe-59**

determination in neutron-irradiated clays and soils, 20: 43607

effects on erythropoiesis in x irradiated rats, 20: 42957

incorporation in tetrahydrated ammonium thallium sulfates, mixed crystal formation in, 20: 43252

use of ferrous citrate-incorporated, for erythropoiesis studies in polycythemia patients, 20: 43015(R) (UCRL-16246, pp 1-18)

use of iron citrate-incorporated for erythropoiesis stimulation studies, 20: 42713(R) (UCRL-16246, pp 107-18)

**IRON NITRATES**

effects on calcination of phosphomolybdate solutions, 20: 43186(T) (ORNL-tr-1344)

**IRON OXIDES**

diffusion into magnesia at 1300 to 1400°C, 20: 43813(R) (COO-1122-3)

**IRON PHOSPHATES**

precipitation of, tracer studies of formation of Liesegang rings during, 20: 43249

**IRON SULFATES**

performance in gamma dosimeters, 20: 43668(R) (ANL-7136, pp 1-16)

use in gamma dosimetry in the ferro to ferri oxidation mode, 20: 43696

**IRON TITANATES**

emissivity as coating in tests on niobium–zirconium alloys, 20: 43816(R) (PWA-2877)

emissivity as coating in test on stainless steel, 20: 43816(R) (PWA-2877)

performance as coating in beryllium emissivity tests, 20: 43816(R) (PWA-2877)

**IRRADIATION FACILITIES**

dosimetry measurements using cobalt-60 well irradiator, 20: 43613

radiation dosimetry of cobalt-60 slab, used in industry, 20: 43621

**IRRADIATION TECHNIQUES**

patient alignment for pituitary exposure to high-energy alpha particles, 20: 43017(R) (UCRL-16246, pp 66-73)

**IRRADIATIONS**

program of gamma, in Canada, 20: 43759 (AECL-2298(Vol.4))

**ISOBUTYRIC ACID**

$\beta$-amino, radiation effects on rat excretion of, x, 20: 42806

**ISOLEUCINE**

acceptance by t-RNA, effects of horseradish peroxidase, 20: 42809

**ISOQUINOLINE**

chemical shifts of protons in, 20: 43282

**ISOQUINOLINE, NITRO-**

spectra of deuterated and normal, PMR, 20: 43282

**ISOTOPE EFFECTS**

in formation of hydrogen from radiolyzed water, 20: 43352

of carbon-14 and tritium on chromatography of methyl esters of linoleic, oleic, and stearic acids, 20: 43394

of deuterium in heavy water on hydrolysis of 2,2,2-trifluoromethyl-*N*-acetanilide, 20: 43280

of sulfur-32 and sulfur-34 on carbon sulfide spectra, 20: 43209

on centrifugal stretching constants in hydrochloric acid, 20: 44123

on hydrogen abstraction from ketones by *tert*-butoxy radicals, 20: 43284

on optical purity of primary alcohols, 20: 43254

quantum-mechanical contribution to, from force constant changes, (T), 20: 43227

**ISOTOPES**

nuclear stability of, systematics of, 20: 44820

research on, technical progress review of, summer 1966, 20: 43758

**ISOTOPIC EQUILIBRATION**
apparatus and method for blood volume determination, 20: 43054(P)
principles of, in radioactivation analysis, 20: 43137
**ISOTOPIC EXCHANGE**
between iodide and iodate ions, effects of chloride, iodide, nitrate, and sulfate ions on, 20: 43248
kinetics of, review of, 20: 43246
of bromine-82 between acetyl bromide and tetra-substituted ammonium bromides, 20: 43247
of deuterium between ammonia and heterocyclic nitrogen compounds, effects of ring position on, 20: 43216
of deuterium with hydrogen on tungsten at 77 to 473°K, 20: 43255
of deuterium with hydrogen in palladium, effects of pressure and temperature on, 20: 43236
of tritium with toluene, mechanism for self-induced, 20: 43268

## J

**JAPAN**
bibliography on studies on atomic bomb survivors in, 20: 42696 (ABCC-0-65)
cesium-137 and strontium-90 in milk in, November 1962 to September 1963, 20: 43520
collection of data from atomic bomb survivors, 20: 42865
environmental contamination in, 1961–64, 20: 43615
fallout monitoring, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
fallout particles in, from Chinese nuclear test, 20: 43528
**JOINTS**
evaluation of Zircaloy-4 to type 316 stainless steel, for pressure tubes, 20: 45098(R) (WCAP-3374-4)
materials for vacuum-tight, preparation and properties of, 20: 43964

## K

**KETONE, CYCLOHEXYL METHYL**
yields in radiolysis of cyclohexane and cyclohexene, 20: 43361
**KETONES**
yields in irradiation of hydrocarbon and carbon dioxide mixtures, 20: 43333
**KIDNEYS**
glomerulonephritis of rat and sheep, etiology and pathology of, 20: 42855(R) (TID-23203)
radiation effects on esterase activity in rat, x, 20: 42824
radiography of veins, using lipiodol, 20: 43024
radioisotope studies of function in, 20: 43051
separation of leukopoiesis-stimulating factor from bovine, 20: 42708(R) (TID-22931)
transplants of human, use of x radiation and drugs to control immune reactions to, 20: 43032
**KNK POWER REACTOR**
description of, 20: 45160
**KRYPTON**
determination by charged-particle reactions at 2 Mev, 20: 43097
effects on properties and structure of tungsten crystallized in, 20: 43937
fission fragment energy-losses in, (E), 20: 44685
ion resonance in weakly ionized, 20: 44889
sorption by boron nitrides, 20: 43067(R) (IDO-14679, pp 6-46)
**KRYPTON IONS**
effects on gain of electron multiplier tubes, (E), 20: 43659
effects on glass surfaces up to 30 kev, 20: 45017
**KRYPTON ISOTOPES Kr-81**
determination of, by beta counting, ionization chamber for, 20: 43106
**KRYPTON ISOTOPES Kr-83**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**KRYPTON ISOTOPES Kr-84**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**KRYPTON ISOTOPES Kr-85**
use as beta source in materials research, 20: 43765
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**KRYPTON ISOTOPES Kr-86**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

## L

**LA CROSSE BOILING WATER REACTOR**
piping system for, fabrication and installation of, 20: 45119 (SWRI-1228-7-34)
pressure vessel materials for, testing of, 20: 45120 (SWRI-1228-7-35)
**LABORATORIES**
calibration of equipment for measuring thyroid radioiodine uptake, 20: 43031
design specifications for radioisotope, 20: 43459
**LABORATORY EQUIPMENT**
description of, for projectile penetration tests, 20: 45240 (SC-RR-66-376)
design and operation of, for sample handling, 20: 43748(P)
design specifications for radioisotope, 20: 43459
**LACQUERS**
radiation effects on films of, cross linking from electron, 20: 43353
**LACTIC ACID**
radiation effects on metabolism of, in bone marrow, 20: 42822
**LACTIC ACID COMPLEXES**
with lanthanide ions, thermodynamic properties of, 20: 43215
**LACTIC ACID, 2-METHYL-**
complexes with lanthanide ions, thermodynamic properties of, 20: 43215
**LAMINATES**
radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
thickness of metal, radiometric gage for measuring, 20: 43642
**LANTHANUM**
activity coefficient of plutonium in liquid, estimated, 20: 43819
content in Gulf of Mexico surface water, 20: 43087(R) (TID-23295, Sect.4)
determination in magnesium alloys, quantometric, 20: 43112
magnetic properties at 2 to 300°K, 20: 43939
separation from other elements by ion exchange using triisooctylamine, 20: 43439
separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)
**LANTHANUM ALLOYS**
Al–La, properties of intermetallic compounds in, tabulation of, 20: 43972
**LANTHANUM CHLORIDES**
covalency in, 20: 43241
neodymium ion interactions in, EPR determination of sign of, 20: 45027
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
**LANTHANUM COMPLEXES**
with antipyrine-salicylates, benzene solvent extraction studies on, 20: 43256
with bipyridines, preparation and properties of, 20: 43259
with boropyrocatechin violet, preparation and properties of, 20: 43223
with glycolic and lactic acids, thermodynamic properties of, 20: 43215
**LANTHANUM FLUORIDES**
lanthanum-139 nuclear quadrupole resonance in, temperature variation of, 20: 45026
$LaF_3$–KF, density and molar volume of, 20: 43165 (BM-RI-6836)
$LaF_3$–LiF, density and molar volume of, 20: 43165 (BM-RI-6836)
$LaF_3$–NaF, density and molar volume of, 20: 43165 (BM-RI-6836)
**LANTHANUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218
**LANTHANUM HYDRIDES**
La–$LaH_x$, phase studies in, 20: 43234
**LANTHANUM HYDROXIDES**
properties as carrier for actinium-228, 20: 43442
**LANTHANUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
reactions with stearate–stearic acid films, tracer studies of, 20: 43238
**LANTHANUM ISOTOPES La-133**
separation of neutron-deficient, from cesium-133, 20: 43067(R) (IDO-14679, pp 6-46)
**LANTHANUM ISOTOPES La-135**
separation of neutron-deficient, from cesium-133, 20: 43067(R) (IDO-14679, pp 6-46)
**LANTHANUM ISOTOPES La-139**
nuclear quadrupole resonance in lanthanum trifluoride, temperature variation of, 20: 45026
proton reactions (p,n) at 8 to 14 Mev, neutron spectra from, (E), 20: 44739
**LANTHANUM ISOTOPES La-140**
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
determination in neutron-irradiated clays and soils, 20: 43607
gamma spectra, (E), 20: 43684
incorporation in stearate–stearic acid solutions, 20: 43238
**LANTHANUM NITRIDES**
magnetic properties at 2 to 300°K, 20: 43939
**LANTHANUM OXIDES**
electron spin resonance spectra of irradiated, 20: 43364
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
$La_2O_3$–$UO_2$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
**LANTHANUM PERRHENATES**

preparation and properties of, 20: 43217
**LANTHANUM PHOSPHATES**
crystal structure of, infrared spectral studies on, 20: 43219
**LANTHANUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219
**LANTHANUM SYSTEMS**
La–LaH$_x$, phase studies in, 20: 43234
**LARVAE**
radiation effects on respiration in developing salmon, γ, 20: 42820
**LARYNX**
carcinoma development following radiotherapy of papillomatosis of juvenile human, 20: 43023
radiotherapy of skin metastases arising from neoplasms in, 20: 43039
**LAVA**
proton radiation effects at 30 kev on, luminescence emission, 20: 44035
**LEACHING**
chemical consumption in uranium ore, reduction of, 20: 43441
**LEAD**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in iron meteorites by fast-neutron activation, 20: 43550(R) (NYO-844-67)
determination in ocean deposits, 20: 43550(R) (NYO-844-67)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
effects on determination of radium-228 by ion exchange and actinium-228 counting, 20: 43442
electric conductivity of thin films of, charge effects on, 20: 44510
electric conductivity of liquid, to 1800°K, 20: 43179(R) (NYO-2082-6)
electric properties of tunnel junctions in superconducting, 20: 44533
electron elastic scattering at 52.9 Mev, cross sections for, (E), 20: 44771
electron tunneling in superconducting point contacts of, infrared frequency response of, (E), 20: 44548
heat transfer in packed beds of, in stagnant air, 20: 43483(R) (RPI-3639-1)
isotopic analysis by activation, role in age estimation of monazites, 20: 43134
neutron inelastic cross sections at 1.7 and 2.1 Mev, (E), 20: 44618 (CONF-660303, pp 726-34)
nucleons reactions with, cascade showers from, (T), 20: 44152
radioinduced diffusion in silver, alpha, (E/T), 20: 44002
reactions of liquid, with tungsten to 1830°K, 20: 43179(R) (NYO-2082-6)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
superconductivity properties with films sandwiches superimposed on, gapless, 20: 44565
superconducting transition temperatures of, crystallite size effects on, 20: 44552
**LEAD ALLOYS**
Bi–Pb, effects of copper plating on magnetization and susceptibility at 4.2°K, 20: 44530
Bi–Pb, magnetic flux retention in hysteretic superconducting, 20: 44521
Bi–Pb, superconducting transition temperatures of, 20: 44515
In–Pb, superconducting transition temperatures of, 20: 44515
Pb–Sn, superconducting transition temperatures of, 20: 44515
Pb–Tl, superconducting transition temperatures of, 20: 44515
Pb–U, combustion kinetics of, 20: 43612
Sb–Pb, superconducting transition temperatures of, 20: 44515
**LEAD IODIDES**
radiation damage in, electron microscopy of fission fragment, 20: 44023
radiation effects on, atomic displacements from fission fragment, 20: 44024
triphenyl-, lead-210 beta decay in, chromatographic studies of distributions from, 20: 43406
**LEAD IONS**
effects on nitrate ion yields from radiolysis of potassium nitrate, 20: 43329
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
**LEAD ISOTOPES**
content in granites of Japan, 20: 43556
content variations in mantle-type materials, 20: 43521
**LEAD ISOTOPES Pb-202**
neutron reactions (n,2n), energy dependence of cross section for, 20: 43550(R) (NYO-844-67)
**LEAD ISOTOPES Pb-204**
abundance in monazites from Chavara (Kerala), age estimation from, 20: 43134
**LEAD ISOTOPES Pb-205**
energy levels of, wave functions for collective properties of low-lying, 20: 44742
**LEAD ISOTOPES Pb-206**
energy levels of, s- and p-wave resonance, (E), 20: 44612 (CONF-660303, pp 562-76)
neutron total cross sections, (E), 20: 44612 (CONF-660303, pp 562-76)
**LEAD ISOTOPES Pb-207**
abundance in monazites from Chavara (Kerala), age estimation from, 20: 43134
meson ($\pi$) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
neutron total cross sections, (E), 20: 44612 (CONF-660303, pp 562-76)
proton elastic and inelastic scattering by, lead-208 isobaric analogue state in, (E/T), 20: 44798
proton inelastic scattering at 24.5 Mev, lead-207 and lead-208 energy levels from, (E), 20: 44801
**LEAD ISOTOPES Pb-208**
abundance in monazites from Chavara (Kerala), age estimation from, 20: 43134
energy levels from proton inelastic scattering at 24.55 Mev, (E), 20: 44772
energy levels from proton inelastic scattering, (E), 20: 44787
energy levels from proton inelastic scattering by lead-207 at 24.5 Mev, (E), 20: 44801
energy levels of, s- and p-wave resonance, (E), 20: 44612 (CONF-660303, pp 562-76)
energy levels of, isobaric analog states of, (E/T), 20: 44798
neutron total cross sections, (E), 20: 44612 (CONF-660303, pp 562-76)
proton elastic and inelastic scattering by, analogue-state resonances in, (T), 20: 44796
**LEAD ISOTOPES Pb-210**
beta decay of, in triphenyl lead iodides, 20: 43406
content in plants and animals of arctic region, 20: 43005
content in tissues of cigarette smokers, 20: 42952
correlation with strontium-90 in human bones, 20: 42781
determination in air-filter samples, radiochemical, 20: 43512(R) (ANL-7136, pp 315-27)
effects of naturally occurring, on environmental radioactivity in New Zealand, 1965, 20: 43581(R) (NP-16245)
**LEAD ISOTOPES Pb-212**
beta particles from, 20: 43525
**LEAD ISOTOPES Pb-214**
measurement in uranium mine air filters, 20: 43594(T) (AEC-tr-6763)
**LEAD ORES**
lead-204 uranium-238 ratio in, 20: 43521
**LEAD SELENIDES**
electron tunneling in superconducting, transverse magnetic field effects on, 20: 44572
**LEAD SULFIDES**
electron tunneling in superconducting, transverse magnetic field effects on, 20: 44572
**LEAD TELLURIDES**
electron tunneling in superconducting, transverse magnetic field effects on, 20: 44572
**LEAKS**
detection in sodium-heated boilers, method for, 20: 45059
**LEAVES**
radiation effects on Coleus, effects on root initiation of γ, 20: 42842(R) (ANL-7136, pp 290-301)
**LECTURES**
on applied thermodynamics of high-temperature refractories, 20: 43913 (UCRL-16256)
on systematics of nuclear stability of isotopes, 20: 44820
on systematics of energy release in nuclear decay, 20: 44821
**LEPTONS**
interactions with $\frac{1}{2}^+$ baryons, form factors for weak, (T), 20: 44215
interactions with baryons, $\frac{1}{2}^+$ baryon currents from, (T), 20: 44350
interactions with mesons, covariant field theoretical calculations of currents from, 20: 44353
**LEUKEMIA**
effects of radioinduced, on thymic cell ultrastructure in mice, 20: 42882
incidence of, among survivors of Japanese atomic disasters 45 years of age or older at time of blast, 20: 42697 (ABCC-18-65)
pathological manifestations of reticulo-endothelial, 20: 42729
radiation effects on blood picture of human chronic lymphocytic, extracorporeal-blood γ, 20: 43013(R) (ORO-2459-1)
radioinduced in mice, pathological manifestations of, 20: 42867
radioinduced lymphatic, in mice, effects of grafting allogenic fetal liver, 20: 42893
radiotherapy of human, autoimmunity development following x, 20: 43027
radiotherapy using phosphorus-32, comparison of clinical results with drug therapy, 20: 43014(R) (RLO-581-10, pp 33-6)
radiotherapy using phosphorus-32, 20: 43045
therapy using triethylene melamine, 20: 43014(R) (RLO-581-10, pp 33-6)

LEUKOCYTES
  content in bone marrow treated with cortisone or nitrogen mustard, 20: 42995
  content of granulocytic, in dogs, effects of typhoid-paratyphoid vaccine on, 20: 42987
  formation and regulation of, 20: 42708(R) (TID-22931)
  lymphopenia in dogs, induction by intravascular implants of yttrium-90, 20: 42902
  radiation effects on proliferation of human lymphocytes in culture, x, 20: 42872
  radiation effects on transformation of blood lymphocyte, to blast cells, x, 20: 42903
  radiation effects on numbers in rabbits and rats, 20: 42937
  radiation effects on rat, internal $\beta$, 20: 42948
  radiation effects on counts of, in rats administered endoxan, x, 20: 42965
  radiation effects on lysosomes isolated from rabbit polymorphonuclear, gamma, 20: 42975
  radioinduced chromosome aberrations in human, following thyroid therapy, $\beta$ and x, 20: 42857(R) (TID-23228)
  radioinduced chromosome aberrations in human, from peripheral blood, 20: 42931
  radiosensitivity of, 20: 42845 (CONF-660543-1)
LEUKOPENIA
  effects of acceleration on, induced in mice by $\gamma$ rays or proton beams, 20: 42985
LEUKOPOIETINS
  effects on leukopoiesis and leukocyte release to circulating blood, 20: 42708(R) (TID-22931)
LEVEL INDICATORS
  catalog of Russian radiometric, 20: 43639(T) (AEC-tr-6633)
LEVEL REGULATORS
  design of radiometric, for continuous steel casting processes, 20: 43761
LIFE SPANS
  effects of atomic explosions on, of Japanese survivors, 20: 42697 (ABCC-18-65)
  effects of starvation or rapidly growing tumors on mouse, 20: 42840(R) (ANL-7136, pp 164-90)
  radiation effects on dog, 20: 42836(R) (ANL-7136, pp 109-23)
  radiation effects on, in mice centrifuged prior to gamma or proton exposure, 20: 42985
  radiation effects on, in mice protected by iproniazid or serotonin, 20: 42991
LIGHT
  detection of intermittent pulses of, 20: 43722
  effects on carbohydrate utilization by plants, 20: 42706(R) (NYO-2373-1)
  effects on deuterioiodic acid–hydrogen system, cross-section and threshold-energy calculations for, 20: 43288(R) (CALT-532-1)
  effects on flower primordia formation in Xanthium, 20: 42842(R) (ANL-7136, pp 290-301)
  effects on metabolism in squash seedlings, 20: 42842(R) (ANL-7136, pp 290-301)
  effects on radioinduced color centers in cesium bromides, 20: 45036
  effects on ultraviolet damage in mammalian cells, photoreactivating, 20: 42869
  response of moth eye to, 20: 42852(R) (ORO-2903-28)
  scattering by plasma, (T), 20: 44938
  scattering of, spectra line intensity in Raman, 20: 44148
LIGROINE
  properties as chromatographic developer, 20: 43406
  solvent properties for fructose, glucose, and sucrose, 20: 43402
LIGURIAN SEA
  radioactivity of plankton samples from, 20: 43536
  seasonal variations of zooplankton in, 20: 42734
LIMBS
  radiation effects on activity in femoral vein of rabbit, following duodenal injection of carbon-14-labeled L-alanine, $\gamma$, 20: 42972
LINEAR ACCELERATORS
  performance and experimental program for 800-Mev proton, with meson factory, 20: 44041 (LA-DC-8144)
LINOLEIC ACID, METHYL ESTER
  separation of labeled, tritium–carbon-14 isotope effects in chromatographic, 20: 43394
LIPIDS
  effects of acetone fraction from liver, on oxidation phosphorylation in irradiated rabbits, 20: 42825
  properties of *Enterobacter cloacae*, 20: 42707(R) (ANL-7136, pp 243-55)
  radioinduced formation of alkanes, alkenes, and olefins from, in meats, 20: 42973
  tracer study of human metabolism of, 20: 42782
LIPOPROTEINS
  ion binding properties of human serum, 20: 42743 (UCRL-14631)
  ion binding properties of cell membrane, 20: 42743 (UCRL-14631)
  particle-size distributions in low-density human plasma, 20: 42717(R) (UCRL-16246, pp 176-85)
  production in human plasma of, comparison of butterfat and corn oil, 20: 42717(R) (UCRL-16246, pp 176-85)
  radioinduced formation of aliphatic hydrocarbons and sulfur compounds from, in meats, 20: 42973
LIQUID METAL COOLED REACTORS
  coolant fires in, properties of sodium, 20: 45047 (NAA-SR-12041)
  design and economics of BN-350, 20: 45159
  development of sodium, Karlsruhe project on, 20: 45148
  development of 300-Mw sodium prototype breeder, 20: 45149
  fuel development for fast breeder, 20: 45106(R) (ANL-7249)
  materials development for, 20: 43809 (BNL-50003)
  reactivity coefficient measurements for fast sodium, 20: 45207(T) (EURFNR-76F)
  reactivity variations in fast sodium, group constants for, 20: 45075 (JAERI-1109)
  safety of, effects of neutron cross section uncertainties on, 20: 45068 (CONF-660303, pp 430-53)
LIQUIDS
  neutron scattering by, in effective width model, (T), 20: 44595
  velocity profiles for, development of, 20: 43482 (ORNL-TM-1519)
LITHIUM
  corrosive effects on niobium–zirconium alloys at 2000°F, 20: 43837 (TIM-823)
  determination by charged-particle reactions at 2 Mev, 20: 43097
  determination in thorium dioxide, spectrographic, 20: 43105
  effects on electron spin resonance of boronated graphite, (E), 20: 44008
  reactions of gaseous, with rare earth chlorides, thermodynamics of, 20: 43222
  separation from aluminum, 20: 43067(R) (IDO-14679, pp 6-46)
LITHIUM ALLOYS
  Li–Mg, machining procedures for, 20: 43864 (Y-1550)
LITHIUM ALUMINATES
  phase studies, 20: 43811(R) (BNWL-269, pp 1.1-28)
  thermal conductivity, 20: 43811(R) (BNWL-269, pp 1.1-28)
LITHIUM CHLORIDES
  purification by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
  $KCl-LiCl-UO_2Cl_2$, electrolysis of molten, at 500 to 600°C, 20: 43266(P)
LITHIUM DEUTERIDES
  hydrogen isotope content variations in, falling drop density method for determining, 20: 43089 (Y-1175(Del.))
LITHIUM, ETHYL-
  spectra of hydrogen and lithium-7 in ether solutions of, NMR, 20: 43392
  ethyllithium–lithium tetraethylaluminate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
  ethyllithium–lithium tetraethylgallate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
LITHIUM FLUORIDES
  color center luminescence in, lithium isotope effects on, 20: 44994 (NYO-3464-2)
  crystal structure of deformed work hardened, 20: 43910(R) (TID-23269)
  performance of thermoluminescent dosimeters, 20: 43747
  production of single-crystal, equipment for, 20: 43910(R) (TID-23269)
  radiation effects on dislocation densities in crystals of, neutron, 20: 43305
  radiation effects on dielectrics and lattice constants of monocrystals of, effects of dose on, 20: 43307
  radiation effects on crystal structure of, neutron, 20: 43303
  radiation effects on hardness of crystals of, gamma, neutron, and x, 20: 43304
  radioinduced color center in, zero-phonon line luminescence at, 20: 44994 (NYO-3464-2)
  radioinduced color centers in, zero-phonon lines of, electron and neutron, (E), 20: 45035
  radioinduced thermoluminescence of magnesium-doped, effects of pre-irradiation annealing on, (E), 20: 45008
  $BeF_2-LiF-ZrF_4$, electrochemical studies of uranium in molten, at 480 to 620°C, 20: 43099
  $CaF_2-LiF$, density and molar volume of, 20: 43165 (BM-RI-6836)
  $CeF_3-LiF$, density and molar volume of, 20: 43165 (BM-RI-6836)
  $LaF_3-LiF$, density and molar volume of, 20: 43165 (BM-RI-6836)
  $LiF-KF$, density and molar volume of, 20: 43165 (BM-RI-6836)
  $LiF-NaF$, density and molar volume of, 20: 43165 (BM-RI-6836)
  $LiF-ThF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
  $LiF-UF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
  $LiF-YF_3$, density and molar volume of, 20: 43165 (BM-RI-6836)
LITHIUM HYDRIDES
  machining procedures for irradiated, 20: 43864 (Y-1550)
LITHIUM IONS
  reactions of monovalent, with dinonylnaphthalenesulfonic acid, effects of diluent on, 20: 43447

**LITHIUM ISOTOPES Li-6**
neutron reactions $(n,\alpha)$ with, cross sections by shell transmission method, 20: 44617 (CONF-660303, pp 701-12)
neutron reactions $(n,\alpha)$ at 25, 67, and 100 kev, cross sections for, (E), 20: 44620 (CONF-660303, pp 763-5)
photodisintegration at high energy, (E), 20: 44644 (LNF-66/32)
**LITHIUM ISOTOPES Li-7**
deuteron reactions (d,n) at 200 kev, beryllium-8 energy levels from, (E), 20: 44677
meson ($\pi$) elastic scattering by, angular momentum coupling and nuclear spins for elastic, (T), 20: 44719
spectra in ether solutions of alkyllithium and lithium tetraalkylmetalate compounds, NMR, 20: 43392
spectra in ether solutions of methyllithium with dimethylmagnesium or dimethylzinc, NMR, 20: 43393
use in neutron-capture therapy, 20: 42840(R) (ANL-7136, pp 164-90)
**LITHIUM, METHYL-**
spectra of hydrogen and lithium-7 in ether solutions of, NMR, 20: 43392
spectra of hydrogen and lithium-7 in ether solutions of dimethylmagnesium or dimethylzinc complexes with, NMR, 20: 43393
lithium tetramethylborate–methyllithium, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetramethylaluminate–methyllithium, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
**LITHIUM MOLYBDATES**
$Li_2MoO_4$–$WO_3$, tungsten oxide single crystal growth in molten, 20: 43257
**LITHIUM NIOBATES**
optical properties of single-crystal, 20: 43950
preparation of chromium and rare earth-doped, 20: 43242
**LITHIUM TETRAETHYLALUMINATE**
spectra of hydrogen and lithium-7 in ether solutions of, NMR, 20: 43392
ethyllithium–lithium tetraethylaluminate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetraethylaluminate–lithium tetraethylgallate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
**LITHIUM TETRAETHYLGALLATE**
spectra of hydrogen and lithium-7 in ether solutions of, NMR, 20: 43392
ethyllithium–lithium tetraethylgallate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetraethylaluminate–lithium tetraethylgallate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
**LITHIUM TETRAMETHYLALUMINATE**
spectra of hydrogen and lithium-7 in ether solutions of, NMR, 20: 43392
lithium tetramethylaluminate–methyllithium, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetramethylaluminate–lithium tetramethylborate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetramethylaluminate–trimethylaluminum, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
**LITHIUM TETRAMETHYLBORATE**
spectra of hydrogen and lithium-7 in ether solutions of, NMR, 20: 43392
lithium tetramethylborate–methyllithium, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetramethylaluminate–lithium tetramethylborate, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
lithium tetramethylborate–trimethylaluminum, NMR spectra of hydrogen and lithium-7 in ether solutions of, 20: 43392
**LITHIUM TUNGSTATES**
use as solvent for cerium oxide crystal growth, (E), 20: 43818
**LIVER**
effects of acetone fraction from lipids of, on oxidative phosphorylation in irradiated rabbits, 20: 42825
gamma-ray induced changes in, effects of dietary casein levels, 20: 42864
horseradish peroxidase effects on t-RNA activity of, 20: 42809
pathogenesis of radioisotope uptake by, and effects on diagnostic value of scintigrams, 20: 43036
radiation dose effects on metastases from Yoshida ascites sarcoma, x, 20: 42962
radiation effects on cells from bovine, x, 20: 42777
radiation effects on nitrogen metabolism of frog, gamma, 20: 42787
radiation effects on esterase activity in rat, x, 20: 42824
radiation effects on acetylcholine esterase activity in rat, 20: 42964
radiation effects on activity in portal vein of rabbit, following duodenal injection of carbon-14-labeled L-alanine, 20: 42972
radiation effects on rat, protective effects of barbamyl and serotonin on $\gamma$, 20: 43008
radioinduced oxycorticosteroid inactivation in dog, $\gamma$, 20: 42808
radioiodination of soluble proteins in rat, using chloramine T, 20: 43274
radioisotope scanning techniques for, 20: 43051
rat, pyridine nucleotide reduction in, 20: 42759
rat, sodium ion efflux from slices of, 20: 42758
rat, sodium ion efflux mechanisms in, 20: 42759
ultraviolet radiation effects on t-RNA activity of, 20: 42809
uptake of iron-59 in x irradiated rats, 20: 42957
use of cells from mouse fetal, for grafting in leukemia, 20: 42893
**LOOPS**
design and fabrication of niobium alloy, for high-temperature potassium and sodium, 20: 43879
design and operation of two-phase flow, 20: 43477 (CONF-661102-1)
design for testing gas-bearing turbocompressors, 20: 43481(R) (NYO-3237-6)
**LOS ALAMOS MOLTEN PLUTONIUM REACTOR EXPERIMENTS**
development of FRCTF, 20: 43829(R) (LA-3582)
**LOS ALAMOS OMEGA WEST REACTOR**
fuel capsule testing in, 20: 43829(R) (LA-3582)
**LOS ALAMOS TURRET REACTOR**
control rod worth calculations for, 20: 43829(R) (LA-3582)
development of, 20: 43829(R) (LA-3582)
fuel element fabrication for, coated-particle, 20: 43855 (LA-DC-6954)
**LUBRICANTS**
development of radiation-resistant, 20: 43493
radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
**LUCENS REACTOR**
moderator vessel of, design and fabrication of, 20: 45169
**LUMINESCENCE**
bibliography on, 20: 43689
conference, 20: 45044
**LUMINESCENT DETECTORS**
use in neutron dosimetry, 20: 43671 (ORNL-P-2467)
**LUNGS**
clearance of uranium dioxide dusts from dog, 20: 42767
effects of beryllium inhalation on, pathological, 20: 42751
effects of beryllium inhalation on, pathological, 20: 42752
effects of beryllium inhalation on, pathological, 20: 42753
effects of beryllium inhalation on, pathological, 20: 42754
effects of radioinduced leukemia on mouse, 20: 42867
evaluation of radiotherapy for metastatic involvement in, 20: 43038
functional impairment of, following $\gamma$ radiotherapy of bronchogenic cancer, 20: 43030
growth rates pulmonary metastases, 20: 43033
incidence of cancer of, among Japanese surviving atomic disasters, 20: 42697 (ABCC-18-65)
lead-210 and polonium-210 content of, comparison of cigarette smokers with non-smokers, 20: 42952
localization of neoplasms in middle lobe of, using various methods, 20: 43037
radiation dose to human, following inhalation of iodine-131- or isomeric technetium-99-labeled albumin, 20: 42797
radiation dose to rodent, in Minas Gerais, Brazil, 20: 43606
radiation dose to, from insoluble and soluble strontium-90, 20: 43631
radiation dosimetry in dog and human, using lithium fluoride thermoluminescent dosimeters, $\gamma$ and x, 20: 43747
radiation effects combined with urethan on tumor induction in mouse, 20: 42873
radioinduced adenomas in mice of different strains, x, 20: 42891
radioinduced pulmonary sclerosis and functional impairment of human, following radiotherapy of bronchogenic cancer, $\gamma$, 20: 43030
radioiodination of soluble proteins in rabbit, using chloramine T, 20: 43274
radioisotope scanning techniques for, 20: 43051
radiotherapy of primary cancers of, x, 20: 43041
radium-226 content in, estimation from radon exhalation, 20: 43604
radon content in uranium miners, from inhalation, 20: 43617
scintillation scanning of, preparation of technetium-99m-labeled human serum albumin for, 20: 43390
sclerosis of, following $\gamma$ radiotherapy of bronchogenic cancer, 20: 43030
tumor induction by beryllium, 20: 42754
**LUTETIUM**
content in Gulf of Mexico surface water, 20: 43087(R) (TID-23295, Sect.4)
magnetic properties at 2 to 300°K, 20: 43939
**LUTETIUM ALLOYS**
Al–Lu, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Lu, crystal structure of intermetallic compound, 20: 43920
Lu–Mn, crystal structure of intermetallic compound, 20: 43918
**LUTETIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
**LUTETIUM COMPLEXES**
with glycolic acid, thermodynamic properties of, 20: 43215
**LUTETIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100

hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221

**LUTETIUM ISOTOPES Lu-172**
gamma spectra, 20: 44634(R) (IDO-17188)
separation from decay products and ytterbium-173 by cation exchange chromatography, 20: 43067(R) (IDO-14679, pp 6-46)

**LUTETIUM ISOTOPES Lu-175**
gyromagnetic ratios, (E/T), 20: 44791

**LUTETIUM NITRIDES**
magnetic properties at 2 to 300°K, 20: 43939

**LUTETIUM PERRHENATES**
preparation and properties of, 20: 43217

**LUTETIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219

**LYMPH CELLS**
effects of phytohemagglutinin on cultured, 20: 43272(R) (RLO-581-10, pp 5-32)
radiation effects on dog, extra-corporeal $\gamma$, 20: 43013(R) (ORO-2459-1)
radiation effects on content in thymus of infant mice, x, 20: 42880
radiation effects on thymocyte nuclei, effect of phosphate metabolism and respiration on x, 20: 42928

**LYMPH SYSTEM**
effects of radioinduced leukemia on mouse, 20: 42867
effects of radioinduced tumors in mouse, on thymic cell ultrastructure, 20: 42882
evaluation of radiotherapy for metastatic involvement of lymph nodes in, 20: 43038
radiation dose to nodes in pulmonary, from insoluble and soluble strontium-90, 20: 43631
radiation effects combined with urethan on tumor induction in mouse, 20: 42873
radiation effects on thymic lymphoid tissue in chicks, restoration after local and whole-body x, 20: 42935
radiation effects on cells of, in mice injected with 5-methoxytryptamine and cystamine, 20: 42938
radiation injuries in human, following external or internal therapy for cancer, 20: 42976
radioinduced tumors in thymus and thoracic modes, 20: 42892
radiotherapy of malignant disease of human, autoimmunity development following x, 20: 43027
role of lymph nodes in mouse, in lymphoid regeneration, 20: 42984

**LYSINE**
acceptance by t-RNA, effects of horseradish peroxidase, 20: 42809
poly-L, gamma-induced viscosity changes in, 20: 42826
radiation effects on synthesis in *Micrococcus glutamicus*, fast neutron and $\gamma$, 20: 42914

**LYSOSOMES**
radiation effects on, isolated from rabbit polymorphonuclear leukocytes, gamma, 20: 42975

**LYSOZYME**
radiation effects on activity of, in serum of rats and rabbits, x, 20: 42944
use as a radioprotective substance, testing in x-irradiated rats, 20: 42993

M

**MACHINE TOOLS**
control of, using isotopes and radiations, 20: 43789
programming of numerically controlled, APT post processor for, 20: 45238 (K-1675)

**MACHINING**
gaging equipment for cylindrical pellet, 20: 43474(P)
methods for unfamiliar materials, 20: 43864 (Y-1550)
radius generation in vibratory deburring, graphs of running time vs., 20: 43847 (BDX-613-85)

**MAGNESIUM**
binding by lipoproteins in blood serum and cell membranes, 20: 42743 (UCRL-14631)
content in Mediterranean Sea, effects of season, temperature, and Nile River flooding on, 20: 43508(R) (NP-16179)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
effects on calcium-to-strontium-90 ratios in barley and oat culture media and tissues, 20: 42766
effects on radiosensitivity of plants, 20: 42915
radioinduced thermoluminescence of lithium fluoride doped with, effects of pre-irradiation annealing on, 20: 45008
reactions of gaseous, with rare earth chlorides, thermodynamics of, 20: 43222
separation of protactinium from, by sorption on activated charcoal, 20: 43148

**MAGNESIUM ALLOYS**
analysis for rare earths and zirconium, quantometric, 20: 43112
Bi–Mg, superconductivity, 20: 44554
Li–Mg, machining procedures for, 20: 43864 (Y-1550)
Mg–Mn, fatigue of, effects of high-frequency vibrations on, 20: 43957
Mg–Pu, thermodynamics of dilute-plutonium liquid, 20: 43819
Mg–Zn, exchange of plutonium in liquid systems with chlorides, thermodynamics of, 20: 43819
Mg–Zr, fatigue of, effects of high-frequency vibrations on, 20: 43957

**MAGNESIUM CHLORIDES**
$KCl-MgCl_2-NaCl-UO_2Cl_2$, electrolysis of molten, at 500 to 600°C, 20: 43266(P)
$MgCl_2-KCl-NaCl$, exchange of plutonium in liquid systems with magnesium–zinc alloys, thermodynamics of, 20: 43819

**MAGNESIUM, DIMETHYL-**
spectra of hydrogen and lithium-7 in ether solutions of methyllithium complexes with, NMR, 20: 43393

**MAGNESIUM ISOTOPES Mg-23**
gamma spectra, 20: 44634(R) (IDO-17188)

**MAGNESIUM ISOTOPES Mg-24**
alpha reactions $(\alpha,p)$ with, testing T-invariance by, (E), 20: 44793
deuteron reactions (d,p) at 2.8 to 6.1 Mev, cross-section fluctuations in, (E), 20: 44738
deuteron reactions $(d,\alpha)$ at 4.5 to 10 Mev, excitation function of, (E), 20: 44768
deuteron reactions (d,p) at 10 Mev, testing T invariance by, (E), 20: 44805
deuteron reactions (d,p) at 5 and 6 Mev, (E), 20: 44737
preparation for radiation targets, from magnesium oxide, 20: 44717
production by cyclotron-produced and cosmic mesons $(\mu)$, 20: 43550(R) (NYO-844-67)
proton reactions (p,n) with, aluminum-24 mass from threshold energy for, (E), 20: 44812

**MAGNESIUM ISOTOPES Mg-25**
deuteron reactions (d,n) at 3 and 5.5 Mev, aluminum-26 energy levels from, (E), 20: 44601(R) (ANL-7218)
deuteron reactions (d,p) at 8.0 Mev, magnesium-26 energy levels from, (E), 20: 44725
gamma spectra, 20: 44634(R) (IDO-17188)
helium-3 reactions (He-3,d) at 17 and 22 Mev, aluminum-26 energy levels from, (E), 20: 44601(R) (ANL-7218)
proton elastic and inelastic scattering at 5 and 6 Mev, (E), 20: 44737
proton elastic and inelastic scattering at 4.5 to 6.1 Mev, cross-section fluctuations in, (E), 20: 44738
proton reactions (p,d) at 15 Mev, testing T invariance by, (E), 20: 44805

**MAGNESIUM ISOTOPES Mg-26**
energy levels from magnesium-25 (d,p) reactions at 8.0 Mev, (E), 20: 44725
proton reactions (p,He-3) at 50 Mev, sodium-24 isobaric analogue states from, (E), 20: 44758

**MAGNESIUM LANTHANUM NITRATES**
proton polarization in dysprosium-doped, (E), 20: 45004

**MAGNESIUM OXIDES**
diffusion into iron oxide at 1300 to 1400°C, 20: 43813(R) (COO-1122-3)
effects on ion-exchange properties of aluminum silicates, 20: 43449
electron absorption coefficients in, up to 1000 kev, 20: 45014
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
spectra of neutron-irradiated, stress effects on, 20: 45025
thermal conductivity of powders of, under compressive stress, 20: 45056

**MAGNET COILS**
design of baseball seam, 20: 44867 (UCRL-70026)
development of pulsed, for superconductor studies, 20: 44512

**MAGNETIC FIELDS**
amplitude and phase of wake, from pulsed charges moving in conducting pipes, (T), 20: 44052
boundary from line currents in streaming plasma, (T), 20: 44912
charged-particle motion in, cyclotron radiation in, 20: 44913
cyclotron radiation emission from intense, (T), 20: 44061
disturbances in interplanetary, by solar flares, (T), 20: 44098
effects on positive column of hot-cathode mercury discharge, (E), 20: 44917
electromagnetic conversion processes at high energies in, (T), 20: 44061
equation of magnetic surfaces in, solution by perturbation method, 20: 44028 (IAE-1150)
hydromagnetic wave propagation in transverse, 20: 44941
inhomogeneities in, detection with charged particles, (T), 20: 44038
intensity in ionospheric sporadic-E layers, correlation with electron density, (T), 20: 44468
interactions with plasma cooled by solid walls, (T), 20: 44905
interactions with plasmoids, properties of acute-angled, 20: 44975
ion rotation in, spectral splitting due to, (T), 20: 44967

plasma containment properties of, book on, 20: 44985(T)
plasma diffusion across spatially periodic, 20: 44973
plasma diffusion across spatially modulated, resonance in, 20: 44974
plasma diffusion in toroidal traps in, effects of disturbances on, 20: 44875(T) (MATT-Trans-37)
plasma jet diffusion across, (T), 20: 44963
plasma stability in, ion diffusion effects on, (T), 20: 44923(T)
production of megagauss, by imploding metallic foils, (E), 20: 44031
production of, design of 625-kJ capacitor battery for, 20: 43457
production of, performance of 625-kJ capacitor battery for, 20: 43458
properties of interstellar, 20: 44881

MAGNETIC MATERIALS
development for high-temperature operation, 20: 43815(R) (NASA-CR-54356)

MAGNETIC MIRROR MACHINES
charged-particle trapping in, lifetime of, 20: 44855 (IAE-1078)
data acquisition system for Alice, tape recorder, 20: 43638 (UCRL-70018)
particle injection through cusp configuration of, properties of, 20: 44971
plasma containment in, pulse-injected, 20: 44972
plasma containment in, nonadiabatic analysis for, 20: 44977

MAGNETIC MIRRORS
cyclotron instability of electron beams in, theory of two-stream, 20: 44894
plasma ion escape from, energy of recharged, 20: 44976

MAGNETIC RECORDING SYSTEMS
development of data acquisition, for Alice, 20: 43638 (UCRL-70018)

MAGNETIC RESONANCE
detection of spin, using bolometers, (E/T), 20: 45007
spectra of F-centers in gamma-irradiated sodium cyanide at 300°K, 20: 43350
spectra recording of EPR, magnetic-field pulse modulation method for, 20: 43657
use of electron spin, in studies of fast neutron damage to silicon, 20: 43986 (AD-637937)

MAGNETISM
Green's function method for antiferromagnetism, (T), 20: 44029 (IS-T-99)

MAGNETOHYDRODYNAMIC CELLS
current density distribution in, with segmented electrodes, 20: 44165 (IPP-3/41)
development, 20: 44169
development and possibilities, 20: 44166
development of combustion-fired, shock tube studies of, 20: 44167
development of, review of, 20: 45184
duct design for, elongated generating, 20: 44171(P)
duct wall design for, 20: 44172(P)
internal resistance of staggered-electrode, 20: 44164 (IPP-3/39)
properties and uses, review, 20: 44175

MAGNETOHYDRODYNAMICS
boundary layer on electrically conducting wall, equation for, 20: 44408
boundary-layer flow equations, 20: 44406
flow of incompressible viscous fluid about electrically conducting obstacle, (T), 20: 44405
fluid flow and extra-thermal ionization in, 20: 44402(R) (AD-628065)
fluid flow in rectangular channel at high Hartmann number, 20: 44413
fluid flow in, numerical integration of equations of motion of viscous, 20: 44404(R) (AD-628179)
gas flow in, electric conductivity of vortex, 20: 44412
gas flow in, hysteresis phenomena in, 20: 44411
gas flow through channels in, hydraulic approximation for, 20: 44407
stability, axisymmetric equilibrium, (T), 20: 44858 (IPP-6/48)
wave propagation in compressible perfect fluid of infinite conductivity, relativistic, 20: 44409

MAGNETOSPHERE
charged-particle inflation of inner, during magnetic storm, (E), 20: 44445
electric currents in, effects on N-S asymmetry of $S_q$, (E/T), 20: 44438
electromagnetic wave propagation in, at hydromagnetic and whistler frequencies, (T), 20: 44469
hydromagnetic wave propagation in, detection of, 20: 44431
protons in, Mariner 4 measurements of low-energy, 20: 44455

MAGNETS
calibration of uncorrected superconducting, 20: 44993 (NYO-2150-19)
design and placement for neutron-proton differential cross section measurements, 20: 44632 (CONF-660303, pp 1084-91)
field uniformity of, use of conformal mapping for improving, 20: 44064
flux density of hexapolar lenses, variations in, 20: 44063
properties of large-volume, highly uniform, at ORNL, 20: 44030 (ORNL-P-2492)
use of quadrupole and box, for focusing and steering particle beams, 20: 44065

MAGNOX ALLOYS
expansion of tubular, equipment for measuring, 20: 43960
fatigue of, effects of high-frequency vibrations on, 20: 43957

MAIZE
radiation effects on seed of, fast-neutron and x, 20: 42843 (BNL-10358)
radiation effects on, effects of nutrient medium on $\gamma$, 20: 42915

MALATHION
labeling with phosphorus-32, 20: 43397

MALEIC ACID
effects on gamma sensitivity of spores of food-spoilage fungi and yeasts, 20: 43784

MALEIMIDE
dioxime of, analytical uses and reactions of, 20: 43095

MALONALDEHYDE
radiation effects on binding of, with heme proteins, 20: 42799(R) (UCB-34P95-1)
radioinduced in amino acids, effects of impurities, 20: 42799(R) (UCB-34P95-1)

MAMMALS
photoreactivation of ultraviolet damage in hamsters and mice, 20: 42869
radiation effects on nitrogen metabolism, comparison with frogs, 20: 42787

MAMMARY GLAND
radiation effects combined with urethan on tumor induction in mouse, 20: 42873
radioinduced carcinogenesis in epithelium of rat, relation of DNA synthesis to x, 20: 42840(R) (ANL-7136, pp 164-90)
radiotherapy of skin metastases arising from neoplasms of, 20: 43039

MAN
analysis for beryllium in tissue and urine samples of, 20: 43108
bone marrow proliferation in, time parameters of, 20: 42705 (BNL-10405)
calcium metabolism in bones of, using radioisotope tracers and whole-body counters, 20: 42764
carcinoma development following radiotherapy of laryngeal papillomatosis in juvenile, 20: 43023
cesium metabolism in, comparison with other mammals, 20: 42768
cesium-137 body burden, relation to dietary intake and excretion, 20: 42794
cesium-137 content in Sweden, correlation with content in reindeer meat, 20: 42736
cesium-137 content in bones in, Moscow, 1961 to 1964, 20: 42741 (NP-16265)
cesium-137 content in Chicago, Ill., 1965, 20: 43512(R) (ANL-7136, pp 315-27)
effects of beryllium on, 20: 42751
effects of beryllium on, 20: 42752
effects of beryllium on, 20: 42753
epidemiological studies of, 20: 42700(R) (ANL-7136, pp 162-3)
formulae for assessing body content of radiostrontium in adult, 20: 42779
gastrointestinal transit time in, for ceramic spheres containing manganese-54 or uranium carbide particles, 20: 42740 (LA-DC-7764)
growth rates pulmonary metastases, 20: 43033
lead-210/strontium-90 correlations in bones, 20: 42781
metabolism of iodine-131-labeled triolein in, as affected by age, 20: 42782
microwave effects on blood serum proteins of, 20: 42876
potassium metabolism in, comparison with other mammals, 20: 42768
potassium-40 content in tissues of, internal radiation dose from, 20: 42940
potassium-42 measurement in, for calibrating potassium-40 gamma detection efficiency of whole-body counter, 20: 42739(R) (COO-1339-3)
radiation burden from fallout, in West Germany, 20: 43626
radiation dose to skeleton of, from strontium isotopes, 20: 43605
radiation dose to, from fluoroscope examinations, 20: 43050
radiation doses to Eskimos ingesting cesium-137, 20: 43622
radiation doses to gonads of, from diagnostic radiography, calculation procedure for, 20: 43026
radiation effects on thyroid in, $\beta$ and x, 20: 42857(R) (TID-23228)
radiation effects on proliferative activity of lymphocytes from, x, 20: 42872
radiation effects on mitosis in erythroblasts of, chronic low-level, 20: 42884
radiation effects on transformation of blood lymphocytes to blast cells in, x, 20: 42903
radiation effects on, dynamics of lethal x, 20: 42934
radiation injuries due to chronic low doses, 20: 42865
radioactivity in, effects of iodine isotopes released during nuclear explosions on, 20: 43574 (CONF-660538-1)
radioactivity uptake by thyroids in children, following nuclear weapons test in Nevada, 20: 43590 (UCRL-14707)
radioinduced autoimmunity following x radiotherapy, 20: 43027
radioinduced chromosome aberrations in, following cancer therapy, 20: 42931
radioinduced lung injuries following radiotherapy of cancer, $\gamma$, 20: 43030

radioisotope contents in Arctic, 20: 43005
radium-226 content in, estimation from radon exhalation, 20: 43604
strontium-85 and -90 uptake and retention in, 20: 42762
strontium-90 in bones from food contamination in New York City, Poland, and Great Britain, 20: 43619
uranium contamination in, measurement by analysis of urine, 20: 43000

**MANDELIC ACID, *p*-BROMO-**
reactions with dysprosium, 20: 43140
use in determination of rare earths in presence of uranium(VI), 20: 43141

**MANDELIC ACID, CHLORO-**
reactions with dysprosium, 20: 43140
use in determination of rare earths in presence of uranium(VI), 20: 43141

**MANGANESE**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in plant materials, activation, 20: 43060 (CEA-R-2967)
determination in seawater, activation, 20: 43085(T) (TID-23295, Sect.2)
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination of trace amounts of, in tungsten and molybdenum by atomic absorption spectrophotometry, 20: 43154
determination of, in carbazole by neutron activation methods, 20: 43116
determination in powder samples by spectrographic methods, semiquantitative, 20: 43104
effects on photometric determination of cerium in cast iron and steels, 20: 43143
machining procedures for, 20: 43864 (Y-1550)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
separation of protactinium from, by sorption on activated charcoal, 20: 43148
separation of, from thorium in sulfuric acid solutions by ion exchange, 20: 43147

**MANGANESE ALLOYS**
Al–Fe–Mn–U, intermetallic compounds of, phase diagrams, 20: 43980
Dy–Mn, crystal structure of intermetallic compound, 20: 43918
Er–Mn, crystal structure of intermetallic compound, 20: 43918
Gd–Mn, crystal structure of intermetallic compound, 20: 43918
Ho–Mn, crystal structure of intermetallic compound, 20: 43918
Lu–Mn, crystal structure of intermetallic compound, 20: 43918
Mg–Mn, fatigue of, effects of high-frequency vibrations on, 20: 43957
Mn–Tb, crystal structure of intermetallic compound, 20: 43918
Mn–Tm, crystal structure of intermetallic compound, 20: 43918

**MANGANESE BROMIDES**
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**MANGANESE CHLORIDES**
effects of injections on protein fractions in serum of irradiated rabbits, 20: 42870
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**MANGANESE(II) FLUORIDES**
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**MANGANESE IODIDES**
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**MANGANESE IONS**
determination of, in pyruvate carboxylase, 20: 42773
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**MANGANESE ISOTOPES Mn-52**
gamma spectra, 20: 44634(R) (IDO-17188)

**MANGANESE ISOTOPES Mn-54**
gamma spectra, 20: 44634(R) (IDO-17188)
gastrointestinal transit of ceramic spheres containing, in animals and man, 20: 42740 (LA-DC-7764)
production of carrier-free, 20: 43398
use in pyruvate carboxylase activity studies, 20: 42773

**MANGANESE ISOTOPES Mn-56**
determination in neutron-irradiated clays and soils, 20: 43607

**MANGANESE OXIDES**
effects on sintering of alumina, 20: 43813(R) (COO-1122-3)
machining procedures for single crystals of, 20: 43864 (Y-1550)
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364

**MANGANESE STEEL**
heat treatments at 900°C, austenizing effects on PM 24, 20: 43891 (EURAEC-1686)

**MANGANESE SULFATES**
spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)

**MANOMETERS**
performance of ionization, for pulse plasma jet pressure measurements, 20: 44978

**MARCOULE REACTORS**
wastes from, process for fixation in glass of, 20: 45231

**MASERS (OPTICAL)**
electric discharge dynamics in large diameter magnetically confined ion gas, 20: 44410
electron interactions with field of, nonrelativistic quantum theory for, 20: 44486
plasma production by high-power, ion energies in, 20: 44932

**MASS SPECTROMETERS**
design for determining molecular beam intensity distribution, 20: 43658
development for determining ion and neutral content of ionosphere, 20: 43648
development of, for use in crossed molecular beam studies, 20: 43288(R) (CALT-532-1)
ion pumps for surface ionization in, 20: 43068(R) (IDO-14679, pp 47-50)
performance for ionization studies in impure shock-heated argon, 20: 43123
use in measuring ion concentrations quantities in ionosphere, 20: 44457
vacuum lock for sample changing in, 20: 43068(R) (IDO-14679, pp 47-50)
vacuum pump for, characteristics of all-metal-exhaust, 20: 43068(R) (IDO-14679, pp 47-50)

**MATERIALS TESTING**
gamma scanning of hot-rolled ingots before cutting, 20: 43870
puncture-resistance, of hot-rolled and stainless steels, 20: 43492 (ORNL-TM-1312(Vol.2))

**MATHEMATICS**
algorithm for $Av = \lambda Bv$, 20: 43805 (ORNL-3980)
Bondi-Metzner group in, representations of generalized, 20: 43807
dose calculations in interstitial radium therapy, 20: 43616
group theory in, Clebsch-Gordon series in, 20: 44322
matrix theory applications in reactor physics calculations, 20: 45058
polynomial equations in, solutions for, 20: 43806 (ORNL-4008)

**MATING**
radiation effects on screw-worm fly, compared with effects of chemosterilants, 20: 42724
radiation effects on patterns of, in *Ips confusus*, $\gamma$, 20: 42883

**MATTER**
book: *Antimatter*, 20: 44282
gravitation equations for space, 20: 44107
interactions of anti-, in atmosphere, (T), 20: 44037

**MEATS**
cesium-137 content in chicken, 20: 42735
cesium-137 content in reindeer, in Sweden, 20: 42736
consumer acceptance and organoleptic tests on irradiated, 20: 43795
effects of feeding radiopasteurized, on vitamin metabolism in dogs, 20: 42793
radioinduced volatile compounds giving undesirable odors and flavors in, 20: 42973
radiopreservation of fish, and resulting effects on microbial assays on refrigerated fillets, 20: 43793
strontium-90 content of, in East Germany from 1961 to 1963, 20: 43538

**MEDICAL PERSONNEL**
experience and training of radiology, effects on dose to patients during fluoroscopy, 20: 43050
radiation monitoring of radiology, in New Zealand, 20: 43581(R) (NP-16245)

**MEDICINE**
industrial, practice in beryllium plants, 20: 42756
psychotic syndromes in residents of Hiroshima exposed to atomic bomb, 20: 42924
radiation sources for use in, preparation of iron-55, 20: 43384
radioisotope uses in veterinary, 20: 42723
review of recent developments in nuclear, 20: 43051
use of short-lived nuclides for research, diagnosis, and therapy, review, 20: 43022

**MEDITERRANEAN SEA**
cesium-137 and strontium-90 content in, 1963-64, 20: 43540
mineral content in eastern, effects of season, temperature, and Nile River flooding on, 20: 43508(R) (NP-16179)
nutrient content and dispersion in plants and animals in, 20: 43508(R) (NP-16179)
oceanography of eastern, effects of Nile River floods on, 20: 43508(R) (NP-16179)

**MEIOSIS**
radiation effects on *Vicia faba* chromosomes during, x, 20: 42921

**MELAMINE, TRIETHYLENE-**
use for treatment of leukemia and polycythemia, 20: 43014(R) (RLO-581-10, pp 33-6)

**MEMBRANE FILTERS**
thermal stability of epoxy, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)

**MEMBRANES**
permeability of lipid, to deuterium oxide and water, 20: 42725
radiation effects on innervation system of dog meninges, 20: 42881
radiation effects on, of lysosomes isolated from rabbit leukocytes, 20: 42975

**MERCURY**
determination in iron meteorites by slow-neutron activation, 20: 43550(R) (NYO-844-67)
determination in ocean deposits, 20: 43550(R) (NYO-844-67)
determination in sagebrush, colorimetric and spectrophotometric, 20: 43067(R) (IDO-14679, pp 6-46)
purification of, method for, 20: 43069(R) (IDO-14679, pp 51-9)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
**MERCURY ALLOYS**
properties of cathode of, for separation of americium and curium-242, 20: 43453
**MERCURY IONS**
effects on gain of electron multiplier tubes, (E), 20: 43659
production in low-voltage capillary ion source, 20: 44119
**MERCURY ISOTOPES**
energy levels, (T), 20: 44788
**MERCURY ISOTOPES Hg-186**
nuclear data sheets, 20: 44713
**MERCURY ISOTOPES Hg-187**
nuclear data sheets, 20: 44714
**MERCURY ISOTOPES Hg-188**
nuclear data sheets, 20: 44715
**MERCURY ISOTOPES Hg-189**
nuclear data sheets, 20: 44716
**MERCURY ISOTOPES Hg-195**
separation of neutron-deficient, from gold-197, 20: 43067(R) (IDO-14679, pp 6-46)
**MERCURY ISOTOPES Hg-197**
incorporation in neohydrin, 20: 43397
standardization of, method for, 20: 43381 (ORNL-P-2433)
use of compounds labeled with, in medicine, 20: 43051
**MERCURY ISOTOPES Hg-198**
energy levels, (T), 20: 44788
**MERCURY ISOTOPES Hg-199**
energy level lifetimes and transition probabilities of, 158- and 208-kev, (E), 20: 44704
**MERCURY ISOTOPES Hg-203**
incorporation in neohydrin, 20: 43397
use of compounds labeled with, in medicine, 20: 43051
**MESIC ATOMS**
hyperfine structure of $\mu$, nuclear charge distribution from, (T), 20: 44721
**MESONS**
decay of scalar, equal-time commutation relations for rates of, 20: 44289
decay of, covariant field theory calculations of electromagnetic and weak currents for, 20: 44354
decay widths and magnetic moments of vector, in $SU_6$ theory, 20: 44203
decays of vector, electro-magnetic, (T), 20: 44355
decays of vector, SU(6) algebra of currents for, 20: 44341
decays of, Cabibbo angle for weak, 20: 44354
decays of, SU(3) theory of strong, 20: 44331
energy levels of, individual-particle approximation of higher-excited, (T), 20: 44220
field theory of vector, degeneracy of physical vacuum in, 20: 44325
form factors of pseudoscalar and vector, collinear groups $SU(3) \otimes SU(3) \otimes U(1)$ and $SU(6)_W$ for electromagnetic, 20: 44394
interactions with leptons and photons, covariant field theoretical calculations of currents from, 20: 44353
interactions with quarks, model for, 20: 44365
interactions with electromagnetic fields, energy-momentum tensor for, 20: 44389
interactions with baryons, quark model for coupling constant relations for, 20: 44221
model for bound-state, Bethe-Salpeter equation in bootstrap, 20: 44197
photoproduction on nucleons near threshold, (T), 20: 44211
photoproduction on nucleons, quark model for, 20: 44239
production of, 800-Mev proton linac for, 20: 44041 (LA-DC-8144)
quadrupole moments of vector, anomalous-electric and magnetic-, (T), 20: 44354
wave functions of, space-time symmetry properties of, 20: 44356
wave functions of, Bethe-Salpeter equation for determining properties of, 20: 44357
**MESONS, RESONANCE**
decay of $\kappa$ (725) and $K^*$ (890), meson ($\mu$) polarization from, (T), 20: 44270
decay width and magnetic moment of $K^*$, (T), 20: 44203
mass formula for $U_6 \otimes U_6 \otimes O_{3\ell}$ group for, 20: 44324
parity and spin of $A_2$, (E), 20: 44178 (UCRL-16881)
photoproduction on protons of $X^0$ (958), Regge-pole model for, (T), 20: 44204
production and decay of $A_1$, $A_2$, and B, in meson ($\pi^-$)-proton interactions at 3.2 and 4.2 Bev/c, (E), 20: 44178 (UCRL-16881)
production of $A_2$ (1286) and R (1675), from meson ($\pi^-$)-proton interactions at 7 and 12 Bev/c, (E), 20: 44245
production of g (1680), in meson ($\pi^-$)-proton interactions at 11 Bev/c, (E), 20: 44241
production of isospin 1 (966), from proton-proton interactions at 3.00 Bev, (E), 20: 44243
production of $K^*$ (1320), from meson ($K^+$)-proton interactions at 4.6 Bev/c, 20: 44265
production of $N^*_{1,1}$ (1420) pion-nucleon P-wave interactions, Chew-Low model for, 20: 44186
production of $\pi^-\pi^0$ (965), in meson ($\pi^-$) interactions with protons at 1.7 Bev/c, (E), 20: 44229
**MESONS ($\eta$)**
decay modes for, (T), 20: 44205
decay of, CP violation in $3\pi$, 20: 44296
decay of, static quark model for, 20: 44235
decay of, test of C invariance in $3\pi$, (E), 20: 44230
**MESONS (K)**
decay of, bounds on $f_-/f_+$ for three-body leptonic, 20: 44260
decay of, meson ($\rho$) universality for rate of $\mu\nu$, 20: 44238
interactions with mesons ($\pi$), one-meson theory for charge distribution from inelastic, 20: 44183
interactions with mesons ($\pi$), meson ($\mu^+$) polarization from resonances, (T), 20: 44270
interactions with protons at high energies, models for inelastic two-body, 20: 44359
production in meson (K)-meson ($\pi$) interactions, meson ($\mu^+$) polarization in, (T), 20: 44270
**MESONS ($K^-$)**
capture by carbon-12, $Y^*_0$(1405) production in, (E), 20: 44657 (UCRL-16602)
capture by emulsion nuclei, hyperfragments, hyperons, and mesons ($\pi$) production in, (E), 20: 44657 (UCRL-16602)
interactions with protons at high energies, branching ratio predictions for, (T), 20: 44237
**MESONS ($K^0$)**
decay of $K^0_1$, evidence of time reversal in $2\pi$, 20: 44193
decay of $K^0$, test of time-reversal invariance in leptonic, (E), 20: 44252
decay of, CP violation in three-body electron, (E), 20: 44259
interactions of mesons ($K^0_1$) with protons at 300 Mev/c, hyperon-meson ($K^0_1$) production ratio of, (E), 20: 44250
interactions with protons at low energies, S-wave scattering length determination from, (E), 20: 44244
mass difference of $K^0_1$ and $K^0_2$, current algebra for nonleptonic decay models for, 20: 44266
**MESONS ($K^+$)**
decay of, extrapolation formula for amplitudes of $\pi^+\gamma\gamma$, 20: 44255
interactions with protons at 2.26 Bev/c, cross sections for $Z^+$ baryon production in, (E), 20: 44195
interactions with protons at 3.0 to 5.0 Bev/c, strangeness +2 meson resonance at 1280 Mev production from, (E), 20: 44262
interactions with protons at 4.6 Bev/c, $K^*$ (1320) production from, (E), 20: 44265
**MESONS ($K^0_{2}$)**
decay of, CP violation in, (E), 20: 44259
**MESONS ($K_{\mu 3}$)**
decay of, meson ($\rho$) universality for rate for, 20: 44238
**MESONS ($K^0_{e3}$)**
decay of, test of CP invariance and $\Delta I = \frac{1}{2}$ rule in, (E/T), 20: 44228
**MESONS ($\mu$)**
capture by oxygen-16, irregular G-parity interaction in, (T), 20: 44767
production at sea-level, from photon-electron cascades, 20: 44160
**MESONS ($\mu^-$)**
capture by helium-3, rate for partial, (T), 20: 44194
decay of oriented-spin, longitudinal and transverse polarization in, (T), 20: 44272
magnetic-moment of, anomalous, (E), 20: 44207
production by proton pair annihilation, effects of form factors on cross sections for, 20: 44188
**MESONS ($\mu^+$)**
emission from $\kappa$ (725) and $K^*$ (890) decay, polarization in, (T), 20: 44270
production by proton pair annihilation, effects of form factors on cross sections for, 20: 44188
**MESONS ($\omega$)**
decay of, branching ratio for $\pi^+\pi^-\pi^0$, (E), 20: 44176 (LNF-66/31)
exchange in meson ($\pi^0$) photoproduction on protons, Reggeized, (T), 20: 44240
production in meson ($\pi^-$)-proton interactions at 11 Bev/c, mechanisms for, (E), 20: 44241
**MESONS ($\omega^\rho$)**
decays of, transition probabilities for, 20: 44354
**MESONS ($\pi$)**

decay of, meson ($\rho$) universality for rate of $\mu\nu$, 20: 44238
decays of, static quark model for, 20: 44200
electroproduction of, radiative corrections to, 20: 44225
exchange of two-body, in nucleon-nucleon interactions at low energies, (T), 20: 44271
interactions with mesons (K) and ($\pi$), one-meson theory for charge distribution from inelastic, 20: 44183
interactions with nucleons, P-wave resonances in Chew-Low model for, 20: 44186
interactions with nucleons at high energies, polarization in charge-exchange, (T), 20: 44201
interactions with deuterons, relativistic impulse approximation for elastic, 20: 44210
interactions with elementary particles, scattering lengths for, (T), 20: 44256
interactions with mesons ($\pi$), scattering lengths for, (T), 20: 44256
interactions with nucleons at high energies, backward and forward peaks for elastic, (T), 20: 44267
interactions with mesons (K), meson ($\mu^+$) polarization from resonances in, (T), 29: 44270
interactions with nucleons, general solution of Chew-Low equations for partial waves in, 20: 44281
interactions with protons at high energies, models for inelastic two-body, 20: 44359
production in mesons ($K^-$) capture by emulsion nuclei, (E), 20: 44657 (UCRL-16602)
scattering by lithium-7, angular momentum coupling and nuclear spins for elastic, 20: 44719

**MESONS ($\pi^-$)**
capture by carbon and oxygen, helium-8 production by, (E), 20: 44770
effects on mouse lymphoma cells, 20: 42859(R) (UCRL-16246, pp 100-2)
interactions with protons at 3.2 and 4.2 Bev/c, multi-pion final states from, (E), 20: 44178 (UCRL-16881)
interactions with bound and free protons at 2.8 Bev/c, ratio of, 20: 44177 (NP-16278)
interactions with protons at 10 Bev, second correction to phase integral for, (T), 20: 44182
interactions with protons at 7 Bev, one-meson theory for charge distribution from inelastic, 20: 44183
interactions with protons at 1.7 Bev/c, $T \geq 1$ dipion (965) enhancement in, (E), 20: 44229
interactions with protons at high energies, branching ratio predictions for, (T), 20: 44237
interactions with protons at 11 Bev/c, structures in $4\pi$ mass system from, (E), 20: 44241
interactions with protons at 7 and 12 Bev/c, structure within $A_2$ (1286) and R (1675) from, (E), 20: 44245
interactions with protons, Regge trajectories for minima in differential cross sections for, 20: 44264
interactions with protons at 4 Bev/c, backward elastic, (T), 20: 44267
interactions with protons, $\rho'$ trajectory contribution to charge-exchange, 20: 44222
reactions at 3.5 Bev/c in nuclear emulsions, helium-8 production in, (E), 20: 44747
reactions with complex nuclei at 25 to 400 Mev, data from inelastic, (E), 20: 44720

**MESONS ($\pi^0$)**
decays of, transition probabilities for, 20: 44354
photoproduction on protons, Reggeized vector meson exchange for, (T), 20: 44240
photoproduction on protons at 1.36 to 3.0 Bev, differential cross section for, (E), 20: 44242

**MESONS ($\pi^+$)**
interactions with protons at high energies, one-Regge-pole exchange model for, 20: 44184
interactions with deuterons at 1.2 and 2.8 Bev/c, cross section for $Z^+$ baryon production in, 20: 44195
interactions with protons at 8 Bev/c, decay angular distributions of resonances from, (E), 20: 44226
interactions with protons at 0.4 to 4 Bev/c, direct channel $\Delta_8$ resonance model for backward elastic, (T), 20: 44236
interactions with protons at high energies, branching ratio predictions for, (T), 20: 44237
interactions with protons at 2.3 to 4.0 Bev, differential cross sections for, (E), 20: 44248
interactions with protons, Regge trajectories for minima in differential cross sections for, 20: 44264
interactions with protons at 4 Bev/c, backward elastic, (T), 20: 44267
reactions with complex nuclei at 25 to 400 Mev, data from inelastic, (E), 20: 44720

**MESONS ($\rho$)**
decay angular distribution from meson ($\pi^+$)-proton interactions at 8 Bev/c, (E), 20: 44226
exchange in meson ($\pi^+$)-proton interactions at high energies, one-Regge-pole exchange model for, 20: 44184

**MESONS ($\rho^+$)**
decay width and magnetic moment of, (T), 20: 44203

**MESONS ($X^0$)**
photoproduction on protons, Regge-pole model for, (T), 20: 44204

**MESOSPHERE**
charged-particle content in, (E), 20: 44463

**METABOLISM**
effects of age on iodine-131-labeled triolein, in man, 20: 42782
effects of simulated altitude on rat iodine, 20: 42745(R) (UCRL-16246, pp 126-37)
interspecies comparisons in mammalian cesium and potassium, 20: 42768
kinetics of calcium-47, in goats, 20: 42739(R) (COO-1339-3)
measurement of cesium-137, in cattle and sheep, 20: 42739(R) (COO-1339-3)
measurement of long-term calcium, in human bones using radioisotope tracers and whole-body counters, 20: 42764
of radiosulfate, in normal and irradiated mouse embryos, 20: 42765
radiation dose effects on thyroid, x, 20: 43029
radiation effects on DNA, in mammalian cells *in vitro*, x, 20: 42777
radiation effects on epiphysis and metaphysis of bones, x, 20: 42785
radiation effects on nitrogen, in frog liver, gamma, 20: 42787
radiation effects on rat thymidine, x, 20: 42806
radiosensitivity of rats with increased, 20: 42959

**METAL COATINGS**
book: *Physics of Metal Coatings*, 20: 43880
properties and cleaning methods for, 20: 43599

**METALLIC FILMS**
Moessbauer effect in thin, Debye-Waller factor for, 20: 44137

**METALLIC FOILS**
implosion of, for magnetic flux compression, (E), 20: 44031
laser-beam reactions with, plasma ion energies from, 20: 44932

**METALLOGRAPHY**
sample mounting in, effects of curing stresses in epoxy resins on, 20: 43906 (ORNL-P-2361)

**METALLURGICAL EQUIPMENT**
control of, using isotopes and radiations, 20: 43789

**METALLURGY**
research programs at Chalk River on, 20: 45234 (AECL-2460)

**METALS**
acoustic wave propagation in, nuclear spin resonance in, 20: 45023
analysis for elements using 2-Mev charged particles, 20: 43097
analysis for uranium, extraction-spectrophotometric, 20: 43067(R) (IDO-14679, pp 6-46)
analysis for uranium, extraction-spectrophotometric, 20: 43071 (IDO-14679, pp 75-191)
decontamination using ultrasonics and cleaning solutions, 20: 43623
diffusion in high-melting powder compacts of, by low-melting liquid metals, 20: 43822
dislocation reactions and hardening in body-centered cubic, 20: 43923
electromagnetic wave propagation in, (T), 20: 44993 (NYO-2150-19)
electromagnetic, plasma, and spin wave interactions in antiferromagnetic coupling of, 20: 43982
ion sputtering on, neutral particle energies from, 20: 44139
machining of, graphs of running time vs. radius generation in, 20: 43847 (BDX-613-85)
neutron scattering by electrons in, cross sections for, (T), 20: 44135
oxidation rate constants for, computer program for, 20: 43172 (NAA-SR-Memo-11966)
positron annihilation in, ladder correction to static dielectric constant for, 20: 44247
radiation effects on rate-controlling mechanism for slip in body-centered-cubic, neutron, 20: 43998 (ORNL-3993)
radiographic detection of flaws in ingots of, gamma, 20: 43870
radioinduced defects in, model for recovery from, 20: 45040
reactions with gases, computer program for calculating weight gains in, 20: 43898 (NAA-SR-Memo-11967)
separation from americium, multi-channel ion exchange process for, 20: 43183 (RL-SEP-729(Rev.))
technology review on high-temperature liquid, 20: 43808 (BNL-991)

**METASTASES**
evaluation of radiotherapy for bone, 20: 43038
growth rates in patients with different types of primary tumors, 20: 43033
radioinduction of, model for, 20: 42963
radiotherapy of cutaneous, arising from internal neoplasms, 20: 43039

**METEORITES**
analysis for antimony, activation, 20: 43080 (ORO-2670-15)
analysis for bismuth, mercury, and thallium by slow neutron activation, 20: 43550(R) (NYO-844-67)
analysis for lead by fast-neutron activation, 20: 43550(R) (NYO-844-67)
dissolution of iron, in sulfuric acid, 20: 43550(R) (NYO-844-67)

halogen abundance and inter-relations in, 20: 44077
isotopic composition of achondritic, cosmic-ray-produced xenon, (E), 20: 44079
proton radiation effects at 30 kev on, luminescence emission, 20: 44035

**METEOROLOGY**
determination of Pleistocene climatic curves by isotope geochemistry, 20: 43557
effects of nuclear detonations on, 20: 43510 (RM-4989-TAB)
effects of ragweed pollen dispersion, 20: 45235 (BNL-957)
effects on climate, 20: 43505(R) (COO-689-60, App.A-5)

**METHACRYLIC ACID, ESTERS**
radioinduced polymerization of emulsions of, gamma, 20: 43374

**METHACRYLIC ACID, METHYL ESTER POLYMERS**
gamma radiation effects on, induced electric conductivity, 20: 44997

**METHACRYLONITRILE**
radioinduced polymerization of emulsions of, gamma, 20: 43374

**METHANE**
carbon deposition from, in fluidized bed at 1900 to 2400°C, (E), 20: 43930
determination in reactor blanket gas, design of continuously operating gas chromatogram for, 20: 43157
evaporation of labeled-, separation coefficients of carbon-12 and -14 in equilibrium, 20: 43093(T) (BNL-tr-84)
heats of vaporization of carbon-12- and -14-labeled, 20: 43093(T) (BNL-tr-84)
hydrogen abstraction from, by hot tritium atoms, theoretical treatment of, 20: 43408
ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122
ionization energy in, measurement of effective, 20: 43193
neutron scattering by gaseous, cold, (T), 20: 44599
nuclear spin coupling constants in, effects of excitation energies on, (T), 20: 44126
production in argon-sensitized radiolysis by liquid propane, 20: 43368
scattering of molecular beams of, by silver single crystals, (E), 20: 44121
yields from irradiation of polyethylene terephthalate, 20: 43378
yields in radiolysis of ethyltoluene isomers, effects of dose, scavenger, and temperature on, 20: 43359
yields in x radiolysis of ethyl mercaptan, 20: 43320
Ar–methane, electron ionization loss at 20 to 150 Mev in, 20: 44232
Ar–methane, ionization energy in, measurement of effective, 20: 43193

**METHANE, CHLOROTRIFLUORO-**
effects on graphite oxidation by air, (E), 20: 43839

**METHANE, DICHLORO-**
effects on gamma-induced polymerization of styrene at −78°C, 20: 43308
effects on polymerization of styrene, 20: 43339

**METHANE, DICHLORODIFLUORO-**
effects on graphite oxidation by air, (E), 20: 43839

**METHANE, HALO-**
nuclear spin coupling constants in, effects of excitation energies on, (T), 20: 44126

**METHANE, IODO-**
formation under reactor accident conditions, chemical equilibrium studies of, 20: 43166 (BMI-1781)
radiolysis of, use of charged plates in collecting products from neutron, 20: 43367
reactions with iodine recoil atoms above 10 ev, excitation function and yields in, 20: 43291 (IA-1096)
removal from air using foams, 20: 43585 (ORNL-TM-1589)
removal from air–steam systems by activated charcoals, 20: 45049 (ORNL-P-2431)
sorption of vapors of, coating development for, 20: 45045(R) (BMI-X-10173)

**METHANE, NITRO-**
detonation of, air-blast wave measurements on, 20: 43461 (PNE-607F)

**METHANE, TRICHLOROFLUORO-**
effects on gamma-induced polymerization of styrene at −78°C, 20: 43308

**METHANOL**
effects on formation of nitrate radicals in pulse radiolysis of nitrate solutions, 20: 43321
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
effects on gamma radiation effects on biphenyl, spectral studies on, 20: 43314
metabolism in mice, effects of catalase activity on, 20: 42837(R) (ANL-7136, pp 124-40)
radiation effects on glassy solutions of, spectral studies on effects of hydrocarbon solutes on gamma, 20: 43314
acetonitrile–methanol, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
butyl acetate–methanol, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
ethyl ether–methanol, solvent properties of, for rare earths in paper chromatographic separation, 20: 43452
methanol–methyl acetate, solvent properties of, for rare earth in paper chromatographic separation, 20: 43452

**METHIONINE**
complexes with uranium, polarography and zone electrophoresis studies on, 20: 43229
formation during electron irradiation of primitive Earth atmosphere, tracer studies of, 20: 42726
metabolism of sulfur-35 labeled, in mice with Ehrlich's ascitic carcinoma, 20: 42728
synthesis in yeast, enzyme reactions for, 20: 42737(R) (ANL-7136, pp 231-42)

**METHYL RED**
solubility of, in heavy water, isotope effects on role of hydrogen bonds in, 20: 43287

**METHYL SULFOXIDE**
acetonitrile–methanol, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224

**METROLOGY**
growth rate of pulmonary metastases in man, 20: 43033
weight changes in irradiated mouse embryos, correlation with radiosulfate metabolism, 20: 42765

**MICA**
age of, estimation by argon-potassium method, 20: 43503(R) (COO-689-60, App.A-3)

**MICE**
acceleration tolerance of, effects of radioprotective agents on, 20: 43004
alcohol metabolism in, effects of catalase activity on, 20: 42837(R) (ANL-7136, pp 124-40)
allometric relation between radiosulfate metabolism and weight changes in embryos, 20: 42765
biological characteristics of populations of, effects of sex-linked mutants on, 20: 42837(R) (ANL-7136, pp 124-40)
brain weight and learning behavior of, effects of genetic factors on, 20: 42833(R) (ANL-7136, pp 16-46)
care of laboratory, program for, 20: 42699(R) (ANL-7136, pp 94-108)
cell proliferation and life span of, effects of starvation on, 20: 42840(R) (ANL-7136, pp 164-90)
cell proliferation and life span of, effects of rapidly growing tumors on, 20: 42840(R) (ANL-7136, pp 164-90)
cesium metabolism in, comparison with other mammals, 20: 42768
effect of 5-methoxytryptamine and cystamine on myelogram of irradiated, 20: 42938
effects of erythropoietin administration in, on stem-cell populations, 20: 42713(R) (UCRL-16246, pp 107-18)
effects of gamma ray or proton irradiation on, following acceleration, 20: 42985
effects of ribonuclease and deoxyribonuclease on development of Ehrlich's ascitic carcinoma, 20: 42728
effects of x rays in combination with acceleration and/or velocity on genetics in, 20: 42986
gastrointestinal transit time in, for ceramic spheres containing manganese-54 or uranium carbide particles, 20: 42740 (LA-DC-7764)
immune reactions to irradiated *Schistosoma cercariae*, 20: 42947
leukocyte colony formation in spleen of, effects of bovine-leukopoiesis-stimulating factor on, 20: 42708(R) (TID-22931)
metabolism of tritium-labeled thymidine in, 20: 42738(R) (ANL-7136, pp 255-65)
mutants of, breeding of acatalasemic and hypocatalasemic, 20: 42837(R) (ANL-7136, pp 124-40)
parasitic infections of, 20: 42854(R) (TID-23127)
plutonium carcinogenicity and metabolism in, 20: 42997(R) (ANL-7136, pp 191-204)
plutonium distribution in bone and reticuloendothelial tissues of, 20: 42997(R) (ANL-7136, pp 191-204)
potassium metabolism in, comparison with other mammals, 20: 42768
radiation chimeras in, effects of antigen excess on immunological tolerance of, 20: 42730
radiation chimeras, effects of bone marrow injections on immune reactions and metabolism in, 20: 42854(R) (TID-23127)
radiation dose effects on recurrent tumor, x, 20: 43035
radiation effects on, γ, neutron, and x, 20: 42833(R) (ANL-7136, pp 16-46)
radiation effects on behavior of deer, neutron, 20: 42833(R) (ANL-7136, pp 16-46)
radiation effects on, use of testis weight for evaluation of x, 20: 42841(R) (ANL-7136, pp 266-89)
radiation effects on lymphoma cells from, negative pion, 20: 42859(R) (UCRL-16246, pp 100-2)
radiation effects on hematology of, x, 20: 42831 (AD-635600)
radiation effects on leukemia induction in, x, 20: 42867
radiation effects combined with urethan on tumor-resistant strain, x,

  20: 42873
  radiation effects on lymphocyte content and morphology of thymus of infant, x, 20: 42880
  radiation effects on growth of cells from experimental fibrosarcoma, x, 20: 42888
  radiation effects on tumor transplants in, x, 20: 42889
  radiation effects on sarcoma immunity in CBA, x, 20: 42890
  radiation effects on, lethal neutron, 20: 42934
  radiation effects on leukemic, phosphorus-32, 20: 43045
  radiation effects on carcinogenesis induced by dimethylbenzanthracene in skin of, beta and x, 20: 42969
  radiation effects on, RBE for 35-Mev electron, 20: 42974
  radiation effects on, *in vitro* studies of lymphoid recovery following, 20: 42984
  radiation effects on, effects of AET and hypoxia on recovery from x, 20: 42988
  radiation effects on, protective effects of vaccines, thiophosphates, and AET against γ and x, 20: 42992
  radiation effects on, protective effects of bone marrow treated with cortisone or nitrogen mustard against, 20: 42995
  radiation effects on, protective effects of indolyl- and mercapto-alkylamines against γ and proton, 20: 43002
  radiation effects on, protective effects of apilac and cystamine against x, 20: 43009
  radiation injuries to oral tissues in, following subcutaneous injection of radionuclides, 20: 42967
  radiation injuries in, protective effects of isologous bone marrow injections against proton, 20: 42981
  radiation injuries in, protective effects of locally administered cysteamine against, 20: 42983
  radiation injuries in, protected by iproniazid or serotonin, x, 20: 42991
  radio- and urethane-induced pulmonary adenomas, x, 20: 42891
  radioinduced leukemia and thymic lymphoma in, effects on thymic cell ultrastructure, 20: 42882
  radioinduced leukemia, effects of grafting cells from different strains, 20: 42893
  radioinduced thymic lymphomas, 20: 42892
  radioinduced tumors in, from external β exposure, 20: 42840(R) (ANL-7136, pp 164-90)
  radioprotective activity of imidazole derivatives in, 20: 42979
  radioprotective effects of sulfur and thiol compounds on, reaction mechanisms of, 20: 42998(R) (EUR-2992.f)
  radiosensitivity of spermatogenic epithelium of, γ and x, 20: 42942
  radiosensitivity of tumors in, as affected by diurnal variations of exposure, x, 20: 43048
  species specificity of reannealed DNA of, 20: 42757
  strontium-85 retention by, effects of thyroid hormones on, 20: 42769
  thermal stability of DNA of, 20: 42757
  weight of tumor-bearing, effects of endogenous hydrogen peroxide on, 20: 42840(R) (ANL-7136, pp 164-90)

**MICROÖRGANISMS**
  cellular fine structure of, 20: 42701(R) (ANL-7136, pp 205-30)
  origin of DNA in cytoplasmic organelles of, tracer study, 20: 42701(R) (ANL-7136, pp 205-30)
  radiation control of growth on sea foods of, 20: 43774
  radiation control of growth on fish, 20: 43775
  radiation effects on food-spoilage, on berries and fruits, gamma, 20: 43782
  recommendations of FAO/WHO/IAEA on radiosterilization of, in food, 20: 43786
  role in formation and decomposition of organic compounds in soil, 20: 42795

**MICROSCOPY**
  development of ultraviolet, for biochemical and cytological studies, 20: 42702(R) (ANL-7136, pp 243-55)

**MICROSOMES**
  radiation effects on uptake of heat-killed sulfur-35-labeled mycobacterial vaccines by rat spleen, x, 20: 42907
  synthesis in bacteria, 20: 42702(R) (ANL-7136, pp 243-55)

**MICROWAVE EQUIPMENT**
  propagation constants of quasi-$\mathrm{TE}_{11}$ modes in cylindrical waveguides, (E), 20: 44903

**MICROWAVE SPECTROMETERS**
  magnetic field calibrator for EPR, 20: 43720

**MICROWAVES**
  effects on protein in blood serum of man and rabbits, 20: 42876
  interactions with nonhomogeneous cylindrical plasma, refraction of, (T), 20: 44981
  interactions with plasma, density determination from, (E), 20: 44982
  interactions with plasma, diagnostics from, (E), 20: 44983
  reflection by plasma, ray-theory interpretation of, 20: 44898

**MILK**
  analysis of, for cesium-137 and strontium-90 by beta-counting after chemical separation, 20: 43532
  cesium-137 content in Chicago, Ill., 1965, 20: 43512(R) (ANL-7136, pp 315-27)
  cesium-137 content in Japanese, November 1962 to September 1963, 20: 43520
  cesium-137 content in, Bombay, 1964 to 1965, 20: 43532
  iodine-131 and -133 content in, following uptake by cows from hay, 20: 43576 (CONF-660621-7)
  iodine-131 levels in, after Chinese nuclear explosion, 20: 43608
  potassium content of, regional and seasonal variations in, 20: 43597
  radioactivity content of, from fallout in West Germany, 20: 43626
  radionuclide content in, dietary intake estimates for, 20: 43573 (CONF-765-13)
  strontium-90 contamination of, methods for removing, 20: 43537
  strontium-90 content in, in Japan, 1963–64, 20: 43610
  strontium-90 content of, in Belo Horizonte, Brazil, 20: 42999 (NP-15934)
  strontium-90 content in Japanese, November 1962 to September 1963, 20: 43520
  strontium-90 content of, in Bombay, 1964 to 1965, 20: 43532
  uptake of radioactivity in, by thyroid in children following nuclear weapons test in Nevada, 20: 43590 (UCRL-14707)

**MINERAL DEPOSITS**
  analysis of, pulsed-neutron equipment for, 20: 43163(P)

**MINERALS**
  age estimation of, in Arizona, 20: 43503(R) (COO-689-60, App.A-3)
  content of excess argon-40 in, 20: 43506(R) (COO-689-60, App.A-6)
  recovery of, use of underground explosions in, 20: 43463 (UCRL-14756)
  ultrasonic attenuation in, effects of structure on, 20: 43500(R) (COO-689-60)

**MINING**
  monitoring methods for atmosphere for uranium, 20: 43594(T) (AEC-tr-6763)
  radon hazards of uranium, 20: 43617

**MINING EQUIPMENT**
  control of, using isotopes and radiations, 20: 43789

**MISSILES**
  penetration of particulate material, 20: 45240 (SC-RR-66-376)

**MITOCHONDRIA**
  radiation effects on ribonucleoproteins of, gamma and x, 20: 42866
  radiation effects on uptake of heat-killed sulfur-35-labeled mycobacterial vaccines by rat spleen, x, 20: 42907
  radioinduced decrease of phosphorus/oxygen ratio in rabbit, by acetone fraction of liver lipids, 20: 42825
  radioinduced swelling and degeneration in retinal cells of rabbit, x, 20: 42958
  vacuolization in thymic cell, in mice suffering from radioinduced leukemia or thymic lymphoma, 20: 42882

**MITOMYCINS**
  effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775

**MITOSIS**
  frequency in tumors, correlation with growth rate, 20: 43033
  radiation effects on, in mouse lymphoma cells, negative pion, 20: 42859(R) (UCRL-16246, pp 100-2)
  radiation effects on, in erythroblasts of man, chronic low-level exposure, 20: 42884
  radiation effects on *Vicia faba* chromosomes during, comparison with exposure during meiosis, 20: 42921
  radiation effects on diurnal variations in frequency of, in root tips of Pinus seedlings, gamma, 20: 42953

**MOLECULAR BEAMS**
  focusing of, alternate-gradient technique for, 20: 44120
  intensity distribution of, design of mass spectrometer for determining, 20: 43658
  reactions of crossed, mass spectrometer for studies on, 20: 43288(R) (CALT-532-1)
  use to study reaction dynamics, instrumentation for crossed, 20: 44109 (CALT-532-3)

**MOLECULES**
  excitation by electrons, cross section for vibrational, 20: 44125
  reactions with molecules, device for studying forces of, 20: 44145

**MOLLUSKS**
  cesium-137 absorption by *Mytilus galloprovicialis*, 20: 42770
  strontium-90 absorption by *Mytilus galloprovicialis*, 20: 42770

**MOLTEN SALT REACTORS**
  design of 1000 Mw(e) power breeder, 20: 45116 (ORNL-3996)
  development and economics of epithermal thorium breeder, 20: 45155
  fuel and fertile stream reprocessing for breeder, design study of continuous fluorination-distillation plant for, 20: 43422 (ORNL-3791)

**MOLYBDENUM**
  analysis for trace elements by atomic absorption spectrophotometry, 20: 43154
  coating by aluminum-base alloys, method for, 20: 43962
  coatings of, compatibility with alumina at high temperatures, 20: 43927

determination by charged-particle reactions at 2 Mev, 20: 43097
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination of trace amounts of, in tungsten by atomic absorption spectrophotometry, 20: 43154
effects on coatability of niobium, 20: 43827 (GTR-19)
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
effects on photometric determination of cerium in cast iron and steels, 20: 43143
etch pits at dislocations in, direct observation of, 20: 43966
machining procedures for, 20: 43864 (Y-1550)
pressing and sintering properties of powders of, 20: 43867
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
separation from technetium by solvent extraction using acetophenone and cyclohexanone, 20: 44817
separation from uranium fission products by precipitation using $\alpha$-benzoin oxime and diethyl ether, 20: 44815
strength at high temperatures, effects of alloying on, 20: 43969
thermal conductivity at high temperatures, 20: 43977

**MOLYBDENUM ALLOY COUPLES**
Mo/Mo–Re, calibration of thermocouples of, pressure effects on, 20: 43636 (UCRL-14993)

**MOLYBDENUM ALLOYS**
coatings for, problems of protective, 20: 43877
Al–Cr–Fe–Mo–Ti, properties of, effects of high-temperature thermomechanical treatment on, 20: 43961
Be–Mo, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Bi–Mo, superconductivity, 20: 44554
Cr–Mo, thermal expansion of, 20: 43964
Cr–Mo–Ti, phase conversions and properties of, 20: 43970
Mo–Nb, mechanical and thermal properties of niobium-base, 20: 43940
Mo–Nb, superconducting transition temperature of 75Nb–25Mo, pressure effects on, 20: 44568
Mo–Nb, thermal expansion of, 20: 43964
Mo–Nb–Ti, mechanical and thermal properties of niobium-base, 20: 43940
Mo–Nb–Ti–U–Zr, ductility of uranium-base, effects of aging, forging, and rolling on, 20: 43883 (AD-637777)
Mo–Re, superconducting transition temperature of 90Mo–10Re, pressure effects on, 20: 44568
Mo–Ta, thermal expansion of, 20: 43964
Mo–U, combustion kinetics of, 20: 43612
Mo–V, thermal expansion of, 20: 43964

**MOLYBDENUM ARSENIDES**
crystal structure of $Mo_2As_3$, 20: 43187

**MOLYBDENUM BRONZES**
preparation, properties, and structure of, phases with potassium, rubidium, and sodium, 20: 43213

**MOLYBDENUM COMPOUNDS**
with molybdenum and tungsten bronzes, preparation, properties, and structure of, 20: 43213

**MOLYBDENUM COUPLES**
Mo/Mo–Re, calibration of thermocouples of, pressure effects on, 20: 43636 (UCRL-14993)

**MOLYBDENUM IONS**
effects on cobalt determination in steel, 20: 43145

**MOLYBDENUM ISOTOPES Mo-93**
separation of neutron-deficient, from zirconium-92, 20: 43067(R) (IDO-14679, pp 6-46)

**MOLYBDENUM ISOTOPES Mo-97**
separation from neutron-deficient technetium-96m, 20: 43067(R) (IDO-14679, pp 6-46)

**MOLYBDENUM ISOTOPES Mo-99**
effects of radiation from, on surface of molybdenum oxide, (E), 20: 44026(T)
yields from spontaneous fission of uranium-238, equilibrium-ratio calculations of, 20: 44815

**MOLYBDENUM ISOTOPES Mo-100**
neutron reactions (n,$\gamma$) with, 20: 44817

**MOLYBDENUM ISOTOPES Mo-101**
decay schemes for, 20: 44817

**MOLYBDENUM OXIDES**
radiation effects of incorporated molybdenum-99 on surface of, (E), 20: 44026(T)

**MOLYBDENUM STEEL**
Cr–Mo, corrosion by sodium in loops, statistical analysis of data on, 20: 43826 (GEAP-4830)
Cr–Mo, mechanical properties of, effects of air, helium, and sodium at 1100°F on, 20: 43897 (MSAR-66-174)
Cr–Mo–Ti, corrosion by sodium in loops, statistical analysis of data on, 20: 43826 (GEAP-4830)

**MOLYBDENUM SYSTEMS**
B–Mo–Nb–Ti, mechanical and thermal properties of niobium-base systems, 20: 43940
B–Mo–Nb–Ti–Zr, mechanical and thermal properties of niobium-base, 20: 43940
B–Mo–Ni, phase composition and properties of, 20: 43973
C–Mo–Ti–Zr, fabrication and properties of TZC, 20: 43830(R) (NASA-CR-72029)
Mo–Ni–$ThO_2$, oxidation and properties of composite effects of high temperatures on, 20: 43845(R) (AD-637573)
Mo–$UO_2$, development for fast reactor fuel, 20: 45100

**MOLYBDENUM ZINC OXIDES**
crystal structure, 20: 43919

**MONAZITES**
age estimation of, by lead–thorium method, 20: 43134
age of, in Japanese granites, 20: 43556
processing of, determination of radium-228 in wastes from, 20: 43442

**MONKEYS**
radiation effects on, dynamics of lethal x, 20: 42934
radiation effects on, effects of antibiotics, blood platelets, and bone marrow on mortality in, 20: 42980
species specificity of reannealed DNA of, 20: 42757

**MONOCHROMATORS**
design of high-resolution Echelle, 20: 44920

**MONTE CARLO METHOD**
use for multiplication factor calculations, 20: 45076 (K-DP-1637)
use in study of one-component plasma, 20: 44910

**MONTMORILLONITES**
sorptive properties for cesium, 20: 43455

**MOON**
proton reactions with surface, luminescence from, 20: 44035

**MORPHOLOGY**
effect on uranium content of zircons, 20: 43565

**MÖSSBAUER EFFECT**
in cobalt-57, effects of heating on, (E), 20: 45033
measurement of, design of high pressure spectrometer for, 20: 43732
theory for thin films, Debye-Waller factor for, 20: 44137
use in geochemistry, equipment for, 20: 43550(R) (NYO-844-67)

**MOUTH**
radiation injuries to, in experimental animals following subcutaneous injection of radionuclides, 20: 42967

**MUCIC ACID**
reactions with dysprosium, 20: 43140

**MUCOPROTEINS**
radiation effects on excretion in rats, x, 20: 42960

**MUCOSA**
radiosensitivity of gastric, $\gamma$, 20: 43019

**MULTIPLICATION FACTOR**
calculation for enriched uranium assemblies, Monte Carlo techniques for, 20: 45076 (K-DP-1637)
measurement for an infinite medium, method for, 20: 45078 (MIT-2344-6)
measurement for thermally fissionable isotopes, (E), 20: 44626 (CONF-660303, pp 919-32)

**MUSCLES**
radiation effects on phospholipid metabolism, gamma, 20: 42796
radiation effects on heart, in frogs and rabbits, 20: 42877
radiation effects on electric conductivity in rat abdominis, gastrocnemius, and rectus, gamma, 20: 42929
radioinduced autolysis in rat abdominis, gastrocnemius, and rectus, gamma, 20: 42929

**MUTATIONS**
effects of sex-linked, on biological characteristics of mouse population, 20: 42837(R) (ANL-7136, pp 124-40)
induction by dinitrophenol in *Vicia faba*, 20: 42913
induction of *E. coli*, role of DNA in, 20: 42838(R) (ANL-7136, pp 140-54)
mechanism for uv-induced, in *E. coli*, 20: 42918
photoreversal of uv-induced, in *E. coli*, 20: 42812
radioinduced biochemical, in *Arabidopsis*, 20: 42900
radioinduced in beans by gamma radiation, 20: 42850(R) (NYO-2043-130)
radioinduced in Ephestia, effects of developmental stage on spectra of x, 20: 42970
radioinduced in *Neurospora*, x, 20: 42926
radioinduced in poliovirus, x, 20: 42966
radioinduced in wheat, x, 20: 42846 (IAEA-2466-13)
radioinduced recessive lethal, in Drosophila second chromosomes, 20: 42922
radioinduced, in cotton, gamma and thermal neutron, 20: 42899
radioinduced, in five varieties of winter wheat, gamma, 20: 42897

**N**

**NAGASAKI**
disease occurrence and mortality patterns of survivors of atomic disaster in, 20: 42697 (ABCC-18-65)

radiation effects on health of population of, 20: 42827(R) (ABCC-58-59)
radiation effects on health of population of, 20: 42828(R) (ABCC-59-60)

**NAPHTHALENE, 1,2,3,4-TETRAHYDRO-**
radiolysis of liquid, mechanism of gamma, 20: 43335

**NAPHTHALENESULFONIC ACID, DINONYL-**
alkali salts of, use as liquid cation exchanger for alkali metal ions and ammonium ion in hexane and chloroform, 20: 43447
solvent properties for americium and europium trivalent ions, 20: 43447

**2-NAPHTHYLAMINE**
1-phenylazo-, solubility of, in heavy water, isotope effects on role of hydrogen bonds in, 20: 43287

**1,5-NAPHTHYRIDINE**
spectra of deuterated and normal, PMR, 20: 43282

**NAPHTHYRIDINE, NITRO-**
spectra of deuterated and normal, PMR, 43282

**NATIONAL REACTOR TESTING STATION**
waste processing at, environmental effects of, 20: 45219

**NATURAL GAS**
recovery and storage of, use of underground explosions in, 20: 43463 (UCRL-14756)
transportation costs in Canada, 20: 45177

**NATURAL WATERS**
distribution and properties of thorium isotopes in, 20: 43535
radioactivity of, method for measurement of, 20: 43124

**NEBULAE**
gamma absorption in Crab, high-energy, 20: 44084
photon emission from quasars, limits of, 20: 44947

**NEMATODES**
effects on central nervous system of ground squirrels, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on development of *Ascaridia galli* in chickens, x, 20: 42968

**NEODYMIUM**
determination in magnesium alloys, quantometric, 20: 43112
determination of, effects of metal ions on spectrophotometric, 20: 43100
magnetic properties at 2 to 300°K, 20: 43939
separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)

**NEODYMIUM ALLOYS**
Al–Nd, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Nd, crystal structure of intermetallic compound, 20: 43920

**NEODYMIUM CHLORIDES**
properties of, magnetic and thermal, 20: 43176 (NP-16302)
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

**NEODYMIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with antipyrine-salicylates, benzene solvent extraction studies on, 20: 43256
with glycolic and lactic acids, thermodynamic properties of, 20: 43215

**NEODYMIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218

**NEODYMIUM IONS**
effects on lithium niobates, doping, 20: 43242
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
interactions in lanthanum chloride, EPR determination of sign of, 20: 45027
preparation of cerium oxide single crystals containing, (E), 20: 43818

**NEODYMIUM ISOTOPES Nd-143**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**NEODYMIUM ISOTOPES Nd-144**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**NEODYMIUM ISOTOPES Nd-145**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**NEODYMIUM ISOTOPES Nd-146**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**NEODYMIUM ISOTOPES Nd-148**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**NEODYMIUM ISOTOPES Nd-150**
alpha reactions $(\alpha,2n)$ at 18 to 20.5 Mev, samarium-152 energy-level transitions from, (E), 20: 44735
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**NEODYMIUM NITRIDES**
magnetic properties at 2 to 300°K, 20: 43939

**NEODYMIUM PERRHENATES**
preparation and properties of, 20: 43217

**NEODYMIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219

**NEODYMIUM SYSTEMS**
C–Nd–O, preparation and properties of $Nd_2O_2C_2$ in, 20: 43214

**NEON**
determination by charged-particle reactions at 2 Mev, 20: 43097
ion resonance in weakly ionized plasma of, 20: 44889
proton reactions with, cross sections for double electron capture by 2- to 50-kev, (E), 20: 44140
scattering of molecular beams of, by silver single crystals, (E), 20: 44121

**NEON IONS**
capture of solar, using aluminum foils, 20: 44697
effects on gain of electron multiplier tubes, (E), 20: 43659
effects on glass surfaces up to 30 kev, 20: 45017

**NEON ISOTOPES Ne-20**
energy levels in SU(3) classification scheme, odd-parity, (T), 20: 44792

**NEON ISOTOPES Ne-21**
energy levels of, low-lying $J = \frac{1}{2}$, (T), 20: 44754

**NEPTUNIUM**
deposition on aluminum, platinum, and stainless steel, target preparation by electrolytic, 20: 43396
separation from americium-241 by solvent extraction, 20: 43072(R) (IDO-14679, pp 193-229)
separation from irradiated uranium dioxide and uranium hydride using phthalocyanine, 20: 43153
separation from protactinium by solvent extraction, 20: 43383

**NEPTUNIUM CHLORIDES**
complexes with cyclopentadiene, preparation and properties of, 20: 43230

**NEPTUNIUM ISOTOPES Np-237**
analysis for protactinium-233, 20: 43383
determination in presence of uranium-235, extraction-radiometric, 20: 43072(R) (IDO-14679, pp 193-229)
determination in the presence of plutonium-239, coincidence methods for, 20: 43158
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)

**NEPTUNIUM ISOTOPES Np-239**
analysis for cerium-143, extraction-radiometric, 20: 43072(R) (IDO-14679, pp 193-229)
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)

**NEPTUNIUM NITRIDES**
decomposition of, at 2210 to 2830°C, 20: 43233

**NERVE CELLS**
radiation effects on ribonucleoproteins of, gamma and x, 20: 42866

**NERVES**
radiation effects on excitation threshold of frog, mechanisms for x, 20: 42868
radiation effects on, of brain meninges in dogs, 20: 42881

**NERVOUS SYSTEM**
radiation effects on cytology and cytochemistry of ribonucleoproteins of, gamma and x, 20: 42866
radiation effects on acetylcholine metabolism in rabbit, $\gamma$, 20: 42875
radiation effects on rat, protective effects of barbamyl and serotonin on $\gamma$, 20: 43008
radiosensitivity of, in man and monkeys, 20: 42934

**NEUROSPORA**
radioinduced mutations in, x, 20: 42926

**NEUTRINOS**
interactions with nucleons, polarized $N^*$ production from, (T), 20: 44276
scattering by nuclei, quasi-elastic, (T), 20: 44740

**NEUTRON ACTIVATION CROSS SECTIONS**
calculation of, 20: 44609 (CONF-660303, pp 315-27)
calculation of, for corrosion products in Yankee, 20: 45126 (WCAP-6072)
computer library collection of, 20: 44608 (CONF-660303, pp 309-14)

**NEUTRON BEAMS**
albedo for limestone concrete of fast, 20: 44988 (NASA-TM-X-1287)

**NEUTRON CAPTURE CROSS SECTIONS**
calculation of multigroup, effect of resonance overlap on, (T), 20: 44582 (NAA-SR-11963)

**NEUTRON CROSS SECTIONS**
accuracy from 0.1 to 100 kev, for calculations on fast reactors, 20: 45092
calculation for fast neutrons, computer program for, 20: 44586 (NAA-SR-Memo-12019)
compilation for reactions on nuclei with Z = 13 to 28, with charged-particle emission, 20: 44671(T) (INDSWG-101, pp 164-223)
conference, 20: 44603 (CONF-660303)
data compilation at BNL, review, 20: 44606 (CONF-660303, pp 226-34)
data evaluation by computer, 20: 44607 (CONF-660303, pp 270-86)

data preparation for reactor calculations, 20: 44583 (NAA-SR-11980 (Vol.1))
determination by reactivity measurements, 20: 44621 (CONF-660303, pp 773-81)
determination by using integral measurement data, 20: 44577 (CONF-660303, pp 304-8)
determination of, source of discrepancies in, 20: 44611 (CONF-660303, pp 486-501)
effect of uncertainties in, on fast reactor calculations, 20: 45069 (CONF-660303, pp 809-20)
effects of uncertainties in, on reactor safety, 20: 45068 (CONF-660303, pp 430-53)
interpretation for fissile nuclide, (T), 20: 44624 (CONF-660303, pp 873-94)
library for tungsten isotopes from 0 to 10 Mev, 20: 44589 (WANL-TME-1472)
measurement and analysis for fissile nuclides, (E/T), 20: 44623 (CONF-660303, pp 840-72)
measurement of total, on radioactive samples, 20: 44604 (CONF-660303, pp 67-74)
measurement techniques, description and evaluation of, 20: 44610 (CONF-660303, pp 381-403)
preparation of group-averaged spectrum-weighted, computer program for, 20: 44584 (NAA-SR-11980(Vol.3))
requirements for reactor design calculations, 20: 45070 (CONF-660303, pp 823-39)
survey of future requirements for the nuclear power industry, 20: 45107 (CONF-660303, pp 1025-34)
tables for aluminum, beryllium, deuterium, iron, nitrogen, oxygen, and silicon from 0.037 ev to 18 Mev, 20: 44661 (UNC-5139)

**NEUTRON-DIFFRACTION ANALYSIS**
equipment for high-pressure, 20: 43473(T)
equipment for, use of silicon diode detector, 20: 43730
intensity in powder, frequency dependence of, 20: 45013

**NEUTRON RESONANCE CROSS SECTIONS**
calculation of multigroup, effect of resonance overlap on, (T), 20: 44582 (NAA-SR-11963)

**NEUTRON SCATTERING CROSS SECTIONS**
calculation for fast neutrons, computer program for, 20: 44645 (NAA-SR-11706)
tables for nuclei with $Z = 3$ to 92, 20: 44668(T) (INDSWG-101, pp 73-108)

**NEUTRON SOURCES**
accelerator tubes for, use of epoxy compounds for cementing isolation rings in, 20: 44059
description and performance of 14-Mev, 20: 44596
design using deuteron beams, with improved voltage control, 20: 44600(P)
intensity of Harwell plutonium-240 standard, 20: 44594
spectrum of americium–beryllium, (E), 20: 44592
use in measuring space-dependent source transfer function in subcritical reactor cores, 20: 45082
use in well logging, 20: 43163(P)
use of deuterium (d,n) reactions in associated-particle method, (E), 20: 44813
use of proton accelerators as pulsed, 20: 44581 (CONF-660303, pp 1055-63)

**NEUTRON SPECTRA**
calculation for fast neutrons, computer program for, 20: 44586 (NAA-SR-Memo-12019)
determination using proportional counters, orthonormal expansion methods for, 20: 43692
determination using boron trifluoride proportional counter, 20: 43694
effects on ductility of irradiated steel, 20: 43997(R) (NRL-Memo-1663)
measurement in bulk media, 20: 44580 (CONF-660303, pp 782-95)
measurement of differential and integral, in heavy water-moderated reactors, 20: 45090
measurement of fast, calibration of large proton-recoil detector for, 20: 43669 (CONF-661001-4)

**NEUTRON SPECTROMETERS**
design of nonpulsed time-of-flight, 20: 44592
development of lithium-6 fluoride-sandwiched silicon, 20: 43718
performance of neutron-decay, 20: 43745

**NEUTRON SPECTROSCOPY**
technique for time-of-flight, using $(\gamma,n)$ reactions to study energy levels of heavy nuclei, 20: 44631 (CONF-660303, pp 1064-72)
time-of-flight technique limitations between 100 ev and 100 kev, 20: 44610 (CONF-660303, pp 381-403)
use of organic scintillators in proton-recoil, 20: 43672 (ORNL-P-2471)

**NEUTRONS**
absorption in reactors, annotated bibliography of poisons for, 20: 45080
attenuation of, measurement of soil moisture by, 20: 43558
book: *Natural Neutron Background of the Atmosphere and Earth Crust,* 20: 43547
bound states of, search for three-body, (E), 20: 44650 (ORNL-P-2412)
buckling in enriched uranium heavy-water lattices, 20: 45084
buckling in reflected reactors, radial, (T), 20: 45085
capture by chromium-50, chromium-51 energy-level spins and transitions from, (E), 20: 44693
capture by deuterium, calculations with elastic unitarity and nonsymmetric three-body wave functions, (T), 20: 44748
capture by hydrogen, gamma ray energy from, 20: 45046(R) (IDO-17192)
capture by iron-56 at 14 Mev, gamma spectrometer for measuring spectra from, 20: 43708
capture by tungsten isotopes at 0.01 to 10 ev, cross sections for, (E), 20: 44605 (CONF-660303, pp 182-203)
capture in thorium and thorium dioxide rods, Doppler coefficients for, (E), 20: 45088
capture-to-fission ratios in low-power reactors, measurement of, 20: 45071 (CONF-660303, pp 1092-7)
color centers in lithium and sodium fluorides induced by, zero-phonon lines of, (E), 20: 45035
decay of, effects of external magnetic field on, (T), 20: 44274
detection of 0.1- to 20-Mev, response functions of organic NE-213 for, 20: 43672 (ORNL-P-2471)
detection of, design and performance of ionization chamber for, 20: 43716
detection of, design of scintillation counter for, 20: 43750
detection of, fabrication of high pressure helium-3 gas scintillation detector for, 20: 43733
detection of, sensitivity of glass-base dosimeter with radioinduced optical density changes for, 20: 43679
diffusion in 60° geometry, seven-point difference equations with arbitrary mesh spacing for, 20: 44590 (WAPD-T-1802)
diffusion length measurements in AGOT graphite, Bragg-induced cold neutron effects in, 20: 44585 (NAA-SR-Memo-11866)
distribution in reactors, correlation theory calculations of, 20: 45053
dose equivalent rates of, orthonormal expansion method for, (T), 20: 43693
dose equivalent rates of, orthonormal expansion method for, 20: 43694
dosimetry in mixed radiation fields, use of multisphere detector for, 20: 43673 (PPAD-596-E)
dosimetry in tissues, performance of low-temperature calorimeters for, 20: 43668(R) (ANL-7136, pp 1-16)
dosimetry of, methods for, 20: 43671 (ORNL-P-2467)
effects on alkali halide crystals, 20: 43303
effects on aluminum, correlation with Frenkel defects, 20: 45037
effects on beryllia, model of, 20: 43985 (AAEC-TM-318)
effects on brazed and welded Inconel and stainless steel joints, 20: 44027
effects on carbon steel and iron, annealing effects on, 20: 44006
effects on cobalt complexes, annealing of, 20: 43366
effects on color centers, crystal structure, and optical properties of potassium chloride crystals, 20: 43306
effects on critical shear stress of nickel, annealing of, 20: 45038
effects on crystal structure of doped iron, (E), 20: 45039
effects on crystal structure of metals, recovery from, (E/T), 20: 45040
effects on cultured hamster cells, biological, 20: 42841(R) (ANL-7136, pp 266-89)
effects on deformation structure of aluminum–copper alloys and copper, 20: 44003
effects on dislocation densities in crystals of lithium fluoride and potassium chloride, 20: 43305
effects on ductility of steel, 20: 43993(R) (EURAEC-1691)
effects on ductility of 316 stainless steels, 20: 44015
effects on electron spin resonance of graphite, (E), 20: 44008
effects on gaseous phosphine and phosphine–silane mixtures, yields of disilane and silane in, 20: 43315
effects on graphite dimensions, two-phase model for, (T), 20: 44007
effects on hardness of crystals of potassium chloride and lithium fluoride, 20: 43304
effects on image restoration in photographs, 20: 43344
effects on mechanical properties of iron, role of interstitial impurities in, 20: 44001
effects on mechanical properties of Inconel X, 20: 44013
effects on mice, lethal, 20: 42934
effects on notch ductility of steels, neutron spectral and annealing effects in, 20: 43997(R) (NRL-Memo-1663)
effects on order-disorder transition in iron–nickel alloy, 20: 44025
effects on phase transformation points in polymorphic solids, thermodynamic calculation of, 20: 45034
effects on rate-controlling mechanism for slip in body-centered-cubic metals, 20: 43998 (ORNL-3993)
effects on refractory concretes, 20: 44005
effects on solid xenon compounds, 20: 43373
effects on strength of copper single crystals, mechanism of, 20: 45030
effects on strength of copper single crystals, mechanism of, 20: 45031
effects on strength of copper single crystals, mechanism of, 20: 45032

effects on tantalum alloy capsules containing liquid plutonium–cobalt–cerium alloy fuel, 20: 43814 (LA-DC-7581)
effects on type 304 stainless steel, methods of reducing, 20: 43999 (ORNL-TM-1544)
effects on yield of early maturing cotton, 20: 42899
embrittlement of ferritic steels by, and recovery, 20: 44019
flux distribution Shippingport core 2 seed 1, wire measurements of, 20: 45125 (WAPD-PWR-TE-203)
flux distribution in BORAX-V, 20: 45202 (ANL-6964)
flux measurements in ATRC, 20: 45046(R) (IDO-17192)
flux spectra determination by foil activation, (E/T), 20: 44579 (CONF-660303, pp 532-53)
in atmosphere, earth crust, and rocks, 20: 43547
interactions with protons at 15 to 30 Mev, recoil technique for differential cross section measurements on, 20: 44632 (CONF-660303, pp 1084-91)
interactions with neutrons in stars, properties of, 20: 44074
kinetics in reactors, space and energy dependence of, 20: 45081
lifetime in subcritical reactors, proof of formula for Rossi-$\alpha$ method for measuring, 20: 45083
moderation of, in soils for determination of moisture content, 20: 43094
photoproduction on helium-3 at 12 to 170 Mev, angular distributions and energies from, (E), 20: 44711(T)
RBE for human body, 20: 42865
reaction $(n,\gamma)$ and (n,2n) with nuclei of bromobenzene and ethyl bromide in benzene, chemical effects from, 20: 43334
reaction with tellurium-130 in telluric acid to produce iodine-131, 20: 43404
reactions $(n,\alpha)$ with nuclei, cross sections for, (T), 20: 44609 (CONF-660303, pp 315-27)
reactions $(n,\alpha)$ with boron-10 and lithium-6, cross sections by shell transmission method, 20: 44617 (CONF-660303, pp 701-12)
reactions $(n,\alpha)$ with lithium-6 at 25, 67, and 100 kev, cross sections for, (E), 20: 44620 (CONF-660303, pp 763-5)
reactions (n,f) with uranium isotopes, energy dependence of delayed-neutron yield in, (E), 20: 44670(T) (INDSWG-101, pp 158-63)
reactions (n,f) with plutonium-241 at 20 to 200 ev, cross sections for, (E), 20: 44625 (CONF-660303, pp 910-18)
reactions (n,f) with plutonium-241 at 0.01 to 0.5 ev, cross section for, (E), 20: 44635 (IN-1012)
reactions $(n,\gamma)$ with nuclei, cross sections for, (T), 20: 44609 (CONF-660303, pp 315-27)
reactions $(n,\gamma)$ with hafnium-178 and ytterbium-176, energy-level transitions in isomeric hafnium-179 and ytterbium-177 from, (E), 20: 44709
reactions $(n,\gamma)$ with germanium and selenium, effects of energy on isomeric cross section ratios in, 20: 44816
reactions $(n,\gamma)$ with molybdenum-100, 20: 44817
reactions (n,p) with nuclei, cross sections for, (T), 20: 44609 (CONF-660303, pp 315-27)
reactions (n,p) with tritium at 20.8 Mev, search for three-body neutron bound state in, (E), 20: 44650 (ORNL-P-2412)
reactions (n,p) with helium-3, spin dependence of, (E), 20: 44804
reactions (n,p) with tritium at 20.8 Mev, trineutrons from, (E), 20: 44809
reactions (n,2n) with nuclei, cross sections for, (T), 20: 44609 (CONF-660303, pp 315-27)
reactions (n,2n) with niobium-93, discrepancy between measured and predicted cross sections for, 20: 44616 (CONF-660303, pp 682-9)
reactions with carbon-12$(n,n')3\alpha$ at 15.5 Mev, (E), 20: 44849
reactions with chromium in ammonium chromate, chromium acetylacetonate, and potassium chromate, preparation of pure chromium-51 using, 20: 43401
reactions with complex nuclei at 25 to 400 Mev, data from inelastic, (E), 20: 44720
reactions with fissionable isotopes, comparison of multilevel and single-level effects on cross sections for, (T), 20: 44630 (CONF-660303, pp 997-1003)
reactions with lead at 1.7 and 2.1 Mev, total inelastic cross sections for, (E), 20: 44618 (CONF-660303, pp 726-34)
reactions with nuclei with $Z = 13$ to 28, with charged-particle emission, 20: 44671(T) (INDSWG-101, pp 164-223)
reactions with uranium-235, spins of resonances in, (E), 20: 44619 (CONF-660303, pp 755-62)
resonance integrals for, sample preparation methods for, 20: 45046(R) (IDO-17192)
scattering angular distributions of, computer program for correcting, 20: 44597
scattering by aluminum, iron, and uranium, inelastic, 20: 44613 (CONF-660303, pp 577-98)
scattering by aluminum at 2.52 Bev, nonelastic, (E), 20: 44828
scattering by carbon-12 at low energy, channel coupling in, (T), 20: 44653 (PUC-937-219)
scattering by chlorine at 14.2 Mev, elastic and inelastic, (E), 20: 44746
scattering by gases and liquid in effective-width model, (T), 20: 44595
scattering by niobium-93 at 14 Mev, differential elastic cross sections for, (E), 20: 44615 (CONF-660303, pp 675-81)
scattering by nuclei, computer analysis of data on differential elastic, 20: 44578 (CONF-660303, pp 335-53)
scattering by nuclei, computer program for solving T matrices for, 20: 44663 (WAPD-TM-571)
scattering by nuclei with $Z = 13$ to 92, cross sections for elastic, 20: 44669(T) (INDSWG-101, pp 109-57)
scattering by nuclei, spin-orbit effects in, (T), 20: 44780
scattering by oxygen-16 at 3 to 4 Mev, (E), 20: 44651 (ORNL-P-2434)
scattering by tungsten-182, tungsten-184, and tungsten-186 at 0.3 to 1.5 Mev, optical-model analysis of, (T), 20: 44646 (NAA-SR-11973)
scattering by uranium-238 at small angles, anomalous elastic, (E), 20: 44764
scattering calculations using Monte Carlo method, direction- and track-selection schemes for, 20: 44588 (ORNL-TM-1484)
scattering model for, effects on calculated reactor parameters, 20: 45065 (CONF-660303, pp 146-50)
scattering models for, formalism and properties of, 20: 44587 (NP-16291)
scattering of polarized, by helium-4 at 12.0 Mev, elastic, (E), 20: 44732
scattering on heavy and light water, models for, 20: 44587 (NP-16291)
solar, search during solar minimum for, 20: 44452
spectra in uranium dioxide tubes at 50 to 750°C, (E/T), 20: 45089
thermalization of, lectures on, (T), 20: 44587 (NP-16291)
transmission in protactinium-233, tantalum-182, and uranium-233, (E), 20: 44604 (CONF-660303, pp 67-74)
transport in heavy-water moderated lattices, (T), 20: 45066 (CONF-660303, pp 151-70)
use in production of short-lived nuclides, 20: 43022

NEUTRONS, COLD
scattering by gaseous methane and ammonia, (T), 20: 44599
scattering by liquid nitrogen, quasi-phonon dispersion in, (E), 20: 44598

NEUTRONS, DELAYED
use in determining oil-water interface in rocks, 20: 43553
yields in neutron fission of uranium isotopes, energy dependence of, (E), 20: 44670(T) (INDSWG-101, pp 158-63)
yields in neutron fission of thorium-232 at threshold, (E), 20: 44672(T) (LA-tr-66-34)

NEUTRONS, EPITHERMAL
scattering by electrons in metals, cross sections for, (T), 20: 44135
scattering by polyethylene, differential inelastic cross sections for, (E), 20: 44576 (CONF-660303, pp 122-33)

NEUTRONS, FAST
detection and measurement of fluxes of, performance of activable-cathode G-M counters for, 20: 43729
distributions in enriched-uranium heavy-water lattices, 20: 45077 (MIT-2344-5)
dosimetry in tissues, use of computers for, 20: 43668(R) (ANL-7136, pp 1-16)
effects on amino acid synthesis in *Micrococcus glutamicus*, 20: 42914
effects on crystal lattices, 20: 43987 (BNL-10569)
effects on crystallinity and thermal conductivity of pyrolytic carbons, 20: 44009
effects on dimensions of graphite and carbon crystals, 20: 44020
effects on elastic properties of graphite, 20: 44018
effects on electric components for SNAP 8, 20: 45194 (NAA-SR-11924)
effects on graphite, interstitial cluster growth from, 20: 44021
effects on maize seed, biological RBE of, 20: 42843 (BNL-10358)
effects on nickel foils, 20: 43990 (BNWL-SA-782)
effects on phosphorus-doped silicon, 20: 43986 (AD-637937)
effects on rubidium uranyl nitrates, 20: 43365
reactions $(n,\gamma n')$ with nuclei, effects on capture and non-elastic spectra, (T), 20: 44614 (CONF-660303, pp 613-22)
reactions with nuclei with $Z = 11$ to 16, total cross sections for, 20: 44743
reactions with plutonium and uranium isotopes, evaluation of published data on fission cross sections for, 20: 44622 (CONF-660303, pp 796-808)
scattering by iron-54 and iron-56 at 2.5 Mev, gamma angular distribution from inelastic, (E), 20: 44813
scattering in boron-10 glass phosphors at 1 to 500 kev, Monte Carlo methods for studying multiple, (E), 20: 43700

NEUTRONS, FISSION
effects on mice, pathological, 20: 42833(R) (ANL-7136, pp 16-46)
effects on rats, co-carcinogenic with 2,7-diacetylaminofluorene, 20: 42840(R) (ANL-7136, pp 164-90)

NEUTRONS, THERMAL
capture by rhodium-103, production of isomeric rhodium-104 in, (E), 20: 44689
capture by rhodium-103, rhodium-104 energy-level transitions from, (E), 20: 44690
detection of, design and performance of ionization chamber with silver electrodes for, 20: 43680
distribution in graphite blocks, 20: 45060

effects on bromopentamminerhodium nitrate and chloropentammineiridium chloride, 20: 43340
effects on intergranular void and crack formation in austenitic steel at 650 to 850°C, 20: 44016
effects on organic halogen compounds, 20: 43367
effects on rubidium uranyl nitrates, 20: 43365
reactions (n,f) with isomeric americium-242, cross sections for, (E), 20: 44708
reactions in clays and soils, gamma spectra from, 20: 43607
reactions with boron glass, helium production by, 20: 44011
reactions with nuclei, with charged-particle emission, 20: 44666(T) (INDSWG-101, pp 1-22)
scattering by ortho- and parahydrogen, (T), 20: 44591
scattering on atomic nuclei, van Hove equation for, 20: 44593
spectra in heavy water-moderated natural uranium lattices, (E/T), 20: 45090

**NEW YORK**
strontium-90 accumulation in bones from contaminated diet, 20: 43619

**NEW ZEALAND**
fallout determination in rainwater in, from 1956 to 1959, 20: 43530
fallout monitoring, 1965, 20: 43581(R) (NP-16245)
radiation protection program, 20: 43581(R) (NP-16245)

**NICKEL**
alpha particle energy loss and straggling in foils of, 20: 44144
coating on 6061 aluminum, corrosion resistance of electroless, 20: 45046(R) (IDO-17192)
corrosion by flowing water at pH 5 and 1000°C, dynamic, 20: 43833 (ORNL-TM-1030)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in boron by x-ray fluorescence, 20: 43091 (UCRL-14879)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination of trace amounts of, in tungsten and molybdenum by atomic absorption spectrophotometry, 20: 43154
effects on exchange of deuterium between aniline and deuterium oxide, 20: 43275
effects on photometric determination of cerium in cast iron and steels, 20: 43143
nickel-61 NMR in single-domain powder of, 20: 45000
preparation and properties of tungsten-fiber reinforced, 20: 43848(R) (BNWL-269, pp 5.1-36)
proton total cross section at 17 Mev, (E), 20: 44662 (USC-136-111)
radiation effects on foils of, neutron, 20: 43990 (BNWL-SA-782)
radiation effects on critical shear stress, annealing of neutron, 20: 45038
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
separation from pitchblende residues, leaching processes for, 20: 43420 (MCW-1508)
use of plating by, in metallographic mounting, 20: 43906 (ORNL-P-2361)

**NICKEL ALLOYS**
mechanical properties of Hastelloy W weld metal, effects of aging on, 20: 43888 (BNWL-290(Pt.1))
wear and corrosion testing as journal bearing material, 20: 43823 (AECL-2566)
Co–Fe–Ni, development of hardened martensitic, as high-temperature magnetic materials, 20: 43815(R) (NASA-CR-54356)
Co–Ni–Ti, creep testing of Nivco, 20: 43815(R) (NASA-CR-54356)
Cu–Ni–W, ductility and tensile properties of tungsten-base, 20: 43822
Fe–Ni, properties for coating metals, 20: 43880
Fe–Ni, radioinduced order-disorder transition in, neutron, 20: 44025
Fe–Ni–W, ductility and tensile properties of tungsten-base, 20: 43822
Fe–Ni–W, ductility and strength of sintered composite, effects of tungsten content on, 20: 43885 (ASRL-TR-132-2)
Ni–Nb–Ti, phase diagrams of, ternary chemical compounds in, 20: 43971

**NICKEL COUPLES**
Al/Ni, corrosion by water at 50°C, 20: 43824 (ANL-6236)

**NICKEL IONS**
effects on cobalt determination in steel, 20: 43145
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100

**NICKEL ISOTOPES**
nuclear model for, testing by proton inelastic scattering, 20: 44658 (UCRL-16984)

**NICKEL ISOTOPES Ni-58**
energy levels from scattering, vibrational, (E/T), 20: 44795
helium-3 reactions (He-3,d) at 16.5 Mev, copper-59 energy levels from, (E), 20: 44837
proton inelastic scattering at 17.6 Mev, testing nuclear model by, (E/T), 20: 44658 (UCRL-16984)

**NICKEL ISOTOPES Ni-60**
energy levels from scattering, vibrational, (E/T), 20: 44795
helium-3 reactions (He-3,d) at 16.5 Mev, copper-61 energy levels from, (E), 20: 44837
proton inelastic scattering at 17.8 Mev, testing nuclear model by, (E/T), 20: 44658 (UCRL-16984)

**NICKEL ISOTOPES Ni-61**
nuclear magnetic resonance of, in single-domain nickel powders, 20: 45000

**NICKEL ISOTOPES Ni-62**
energy levels from scattering, vibrational, (E/T), 20: 44795
proton scattering by, isobaric analog states from, (E), 20: 44761

**NICKEL ISOTOPES Ni-64**
energy levels from scattering, vibrational, (E/T), 20: 44795
proton scattering by, isobaric analog states from, (E), 20: 44761

**NICKEL ISOTOPES Ni-65**
gamma spectra, 20: 44634(R) (IDO-17188)

**NICKEL OXIDES**
effects on radioinduced polymerization of styrene, 20: 43338
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364

**NICKEL SYSTEMS**
$Al_2O_3$–Ni, mechanical properties of alumina-whisker reinforced, 20: 43848(R) (BNWL-269, pp 5.1-36)
$Al_2O_3$–Ni, oxidation and properties of, effects of high temperatures on composites of, 20: 43845(R) (AD-637573)
$Al_2O_3$–Ni, oxidation and properties of, effects of high temperatures on cermet, 20: 43845(R) (AD-637573)
B–Mo–Ni, phase composition and properties of, 20: 43973
Co–Ni–$ThO_2$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
Cr–Ni–P, radiation effects on AWS BNi-7 braze, in-reactor, 20: 44027
Cr–Ni–$ThO_2$, oxidation and properties of composite effects of high temperatures on, 20: 43845(R) (AD-637573)
Mo–Ni–$ThO_2$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
Ni–$ThO_2$, corrosion in oxidizing atmospheres at high temperatures, 20: 43842
Ni–$ThO_2$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
Ni–$ThO_2$, substructure of TD nickel, electron transmission microscopic studies, 20: 43882(R) (AD-636487)
Ni–$ThO_2$–U, agglomeration and segregation of thoria in, at 800°C, 20: 43902 (NMI-7018)
Ni–$ThO_2$–W, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)

**NIOBIUM**
analysis of, for iron by atomic absorption spectrophotometry, 20: 43162
book: *Production Technology of Niobium and Niobium Alloys*, 20: 43984
coating by aluminum-base alloys, method for, 20: 43962
coating of, effects of additives on, 20: 43827 (GTR-19)
coating of, for corrosion protection, 20: 43905 (ORNL-3212)
coating of, for oxidation protection at 0 to 2000°F, 20: 43827 (GTR-19)
coating with aluminum–tin for oxidation protection at 2000°F, 20: 43836 (TID-17070)
compatibility with hydrogen in presence of thermal gradient, 20: 43832 (NASA-TN-D-3546)
determination in columbites and samarskites, 20: 43131
diffusion in niobium carbides at 1700 to 2300°C, 20: 43954
electron tunneling in superconducting point contacts of, infrared frequency response of, (E), 20: 44548
magnetic flux retention in hysteretic superconducting, 20: 44521
magnetization of superconducting, peak effect in, 20: 44528
properties at high temperatures, compilation to 1957, 20: 43908 (PWAC-237)
properties of, effects of alloying elements on, 20: 43905 (ORNL-3212)
reactions with graphite at 1700 to 2300°C, kinetics of, 20: 43954
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
separation from tantalum by column extraction using TBP in kerosene, tracer studies of, 20: 43131
separation from tantalum by solvent extraction using TBP, 20: 43437
separation from tantalum by paper chromatography using amines, 20: 43446
separation of, from tantalum by reaction of the mixed pentachlorides with calcium fluoride and calcium oxide, 20: 43170 (IS-T-107)
strain aging, effect of stress on, 20: 43965
strength at high temperatures, effects of alloying on, 20: 43969
technology and uses of, review, 20: 43817(T) (JPRS-36718)
thermal conductivity and blackness at high temperatures, 20: 43976
ultrasonic wave attenuation in superconducting, 20: 44529

**NIOBIUM ALLOYS**
book: *Production Technology of Niobium and Niobium Alloys*, 20: 43984
coating of, for oxidation protection at 0 to 2000°F, 20: 43827 (GTR-19)
coating of, with oxidation-resistant silicides, fluidized-bed process for,

20: 43881
coating with aluminum–tin for oxidation protection at 2000°F, 20: 43836 (TID-17070)
coatings for, problems of protective, 20: 43877
compatibility with hydrogen in presence of thermal gradient, 20: 43832 (NASA-TN-D-3546)
corrosion, stability, and strength of, 20: 43905 (ORNL-3212)
extrusion parameters for Cb-132M billets, 20: 43831(R) (NASA-CR-72057)
technology and uses of, review, 20: 43817(T) (JPRS-36718)
Al–Nb–Ti, properties at high temperatures, 20: 43963
Be–Nb, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Co–Nb, decomposition and structure of supersaturated, 20: 43938
Mo–Nb, mechanical and thermal properties of niobium-base, 20: 43940
Mo–Nb, superconducting transition temperature of 75Nb–25Mo, pressure effects on, 20: 44568
Mo–Nb, thermal expansion of, 20: 43964
Mo–Nb–Ti, mechanical and thermal properties of niobium-base, 20: 43940
Mo–Nb–Ti–U–Zr, ductility of uranium-base, effects of aging, forging, and rolling on, 20: 43883 (AD-637777)
Nb–Re, hydrogen absorption in, 20: 43832 (NASA-TN-D-3546)
Nb–Ta, atomic structure of solid solutions of, x-ray-scattering study of, (E), 20: 43975(T)
Nb–Ta, electron tunneling in superconducting point contacts of, infrared frequency response of, (E), 20: 44548
Nb–U, combustion kinetics of, 20: 43612
Nb–V, ductile-to-brittle transitions in, enhancement of, 20: 43893 (KAPL-3119)
Nb–V, ductile-to-brittle transitions in, grain boundary effects on, 20: 43894 (KAPL-3146)
Nb–V, thermal expansion of, 20: 43964
Nb–W, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
Nb–W–Zr, coating of, with oxidation-resistant silicides, fluidized-bed process for, 20: 43881
Nb–Zr, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
Nb–Zr, corrosion by lithium at 2000°F, 20: 43837 (TIM-823)
Nb–Zr, emissivity of titanate-coated, at high temperatures, 20: 43816(R) (PWA-2877)
Nb–Zr, fabrication of Zircaloy-4-clad pressure tubing of, 20: 43862 (TID-23312)
Nb–Zr, fabrication of loops of, for liquid potassium and sodium, 20: 43879
Nb–Zr, properties at high temperatures, compilation to 1957, 20: 43908 (PWAC-237)
Nb–Zr, radiation effects on critical current peak vs magnetic field behavior of superconducting, 20: 44505
Nb–Zr, superconducting properties of copper-enclosed, pressure effects on, 20: 44526
Nb–Zr, superconducting critical field measurements for, resistive effects on surface, 20: 44534
Nb–Zr, welding to T-111 alloy, 20: 43830(R) (NASA-CR-72029)
Ni–Nb–Ti, phase diagrams of, ternary chemical compounds in, 20: 43971

**NIOBIUM CARBIDES**
containment in graphite crucibles at 3800 to 4700°K, 20: 43174 (NASA-CR-608)
heat of formation of, 20: 43261
preparation and properties of 100–1000 A particles of, 20: 43951
production by graphite–niobium reactions at 1700 to 2300°C, kinetics of, 20: 43954

**NIOBIUM COMPOUNDS**
technology and uses of, review, 20: 43817(T) (JPRS-36718)

**NIOBIUM ISOTOPES Nb-93**
neutron reactions (n,2n) with, discrepancy between measured and predicted cross sections for, 20: 44616 (CONF-660303, pp 682-9)
neutron scattering at 14 Mev, differential elastic cross sections for, (E), 20: 44615 (CONF-660303, pp 675-81)
proton reactions (p,n) at 8 to 14 Mev, neutron spectra from, (E), 20: 44739

**NIOBIUM ISOTOPES Nb-95**
content in environment in Japan, 1961–64, 20: 43615
distribution in water and silt of British estuaries, 20: 45224
effects on determination of rhodium-106 and ruthenium-106 using coincidence methods, 20: 43158
fractionation in fallout from Chinese and Russian tests, 20: 43528
preparation and separation from zirconium-95 by ion exchange, 20: 43433
separation from irradiated uranium oxides using molten sodium chloride, 20: 43454

**NIOBIUM OXIDES**
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
separation from niobite–tantalite ore by solvent extraction using TBP, 20: 43437
solubility of, in nitric acid–hydrofluoric acid solutions at 25°C, 20: 43226
$Nb_2O_5$–$WO_3$, phase diagram of, 20: 45012

**NIOBIUM OXYFLUORIDES**
solubility of, in nitric acid–hydrofluoric acid solutions at 25°C, 20: 43226

**NIOBIUM SYSTEMS**
B–Mo–Nb–Ti, mechanical and thermal properties of niobium-base systems, 20: 43940
B–Mo–Nb–Ti–Zr, mechanical and thermal properties of niobium-base, 20: 43940
Nb–O–W, crystal structure of $Nb_{16}W_{18}O_{94}$ in, 20: 43188

**NITRATE IONS**
effect on primary hydrogen yields in gamma radiolysis of aqueous organic solutions, 20: 43351
effects on isotopic exchange between iodide and iodate ions, 20: 43248

**NITRATES**
determination in aqueous solutions and solids, titrimetric, 20: 43071 (IDO-14679, pp 75-191)
ethanol–nitrates, radiolysis of, yields of primary hydrogen during gamma, 20: 43351
formates–nitrates, radiolysis of, yields of primary hydrogen during gamma, 20: 43351
yields from radiolysis of potassium nitrate, effects of lead, strontium, sulfate, and thallium ions on, 20: 43329
2-propanol–nitrates, radiolysis of, yields of primary hydrogen during gamma, 20: 43351

**NITRIC ACID**
effects on radiation effects on lithium fluoride monocrystals, 20: 43307
radiolysis of, effects of methanol and nitrite radicals on yields from pulse, 20: 43321
thorium separation from, by solvent extraction using TBP, 20: 43450
$Al(NO_3)_3$–HF–$HNO_3$, effects on dissolution of aluminum-canned irradiated thorium dioxide, 20: 43412 (DP-1044)

**NITRITES**
effects on formation of nitrate radicals in pulse radiolysis of nitrate solutions, 20: 43321

**NITROGEN**
atomic density measurements in afterglow plasma of, 20: 44852 (AD-629924)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in steel by x-ray spectrochemical methods, 20: 43161
determination in uranium nitride, comparison of Dumas and Kjeldahl methods for, 20: 43109
determination of, in gases by deuteron irradiation and neutron time-of-flight spectroscopy, 20: 43115
effects on chlorination of uranium (IV) oxide, 20: 43443
effects on gamma-induced inactivation of transforming DNA, 20: 42818
effects on niobium–vanadium alloy ductile-to-brittle transitions, 20: 43893 (KAPL-3119)
electric discharge in, intensity of spectral bands from, 20: 44884
electron excitation of molecular, cross section for vibrational, (T), 20: 44125
electron temperature of, in afterglow plasma, (E), 20: 44942
fission fragment energy-losses in, (E), 20: 44685
fixation of, development and economics of chemonuclear processes for, 20: 43300
interactions with hydrogen atoms, cross sections for molecular, 20: 44146
neutron cross sections from 0.037 ev to 18 Mev, tables of, 20: 44661 (UNC-5139)
neutron scattering by liquid, quasi-phonon dispersion for cold, (E), 20: 44598
radiation effects on metabolism of, in frog liver, gamma, 20: 42787
radiation effects on oxidation of, electron and ion recombinations in, 20: 43354
radiation effects on content in serum of rabbits, x, 20: 42870
radioprotective effects on *Vicia faba* seedlings, 20: 43007
reactions with uranium at 470 to 1000°C, composition of uranium nitrides produced by, 20: 43191
separation from thorium by electrotransport, 20: 43820
sorption by gamma-irradiated quartz, 20: 43302
sorption by zeolites at low pressures and temperatures, 20: 43499
spectra at 30 ev, energy losses in electron-impact, 20: 43288(R) (CALT-532-1)
spectra from plasma of, Stark widths of, 20: 44931
tracer studies on soil organic, 20: 42795
use in gas bearings, 20: 43469 (TID-23350)

**NITROGEN COMPOUNDS**
radiation effects on content in blood and urine of dogs, partial-body x, 20: 42939

**NITROGEN IONS**
reactions of nitric oxide with atomic and molecular, charge transfer,

20: 44127

**NITROGEN ISOTOPES N-12**

mass from threshold energy for carbon-12 (p,n) reactions, (E), 20: 44811

**NITROGEN ISOTOPES N-13**

energy levels of, lifetime of, (E), 20: 44731

**NITROGEN ISOTOPES N-14**

deuteron reactions (d,t) and (d,He-3) with, cross sections for, (E), 20: 44794

energy levels from carbon-13 (d,n) and (He-3,d) reactions, (E), 20: 44601(R) (ANL-7218)

energy levels from proton inelastic scattering at 7 to 11 Mev, (E), 20: 44840

energy-level transitions in, mixing ratios for, (T), 20: 44784

triton reactions (t,p) at 1195 Mev, nitrogen-16 energy levels from, (E), 20: 44730

**NITROGEN ISOTOPES N-15**

determination in gases, by proton irradiation and neutron time-of-flight spectroscopy, 20: 43115

deuteron reactions (d,p) at 11.98 Mev, nitrogen-16 energy levels from, (E), 20: 44730

energy-level transitions in, 6.33-Mev, (T), 20: 44783

energy-level transitions in, mixing ratios for, (T), 20: 44784

labeling positions in ricinine, mass spectral studies on, 20: 43382

role in soil organic matter research, 20: 42795

**NITROGEN ISOTOPES N-16**

energy-level structure, (E), 20: 44730

**NITROGEN ISOTOPES N-17**

use as delayed neutron source for determination of oil-water interface, 20: 43553

**NITROGEN MUSTARDS**

effects on antigenicity of bone marrow transplants in mice, 20: 42995

effects on DNA molecule, site and mechanism of action, 20: 42821

use for therapy of lymphomas, 20: 43014(R) (RLO-581-10, pp 33-6)

**NITROGEN OXIDES**

concentration in ionospheric D region, electron density for determining, 20: 44436

radiolysis of 2-propanol in, gamma, 20: 43318

radioprotective effects on *Vicia faba* seedlings, 20: 43007

reactions with atomic and molecular ions of oxygen and nitrogen, charge transfer, 20: 44127

**NITROSO COMPOUNDS**

spectra of aqueous solutions of nitrosodisulfonate, ESR, 20: 43184 (UCRL-17064)

**NORTH AMERICA**

evolution during post-Turonian time, 20: 43500(R) (COO-689-60)

**NOZZLES**

effect on internal and external pressures in spherical pressure vessels, theory evaluation for, 20: 43467 (TID-23343)

effects on stresses in spherical pressure vessel, 20: 43491 (ORNL-P-2472)

flexibility in spherical heads, 20: 43468 (TID-23344)

**NUCLEAR BATTERIES**

development, 20: 44169

**NUCLEAR CHEMISTRY**

book: *Nuclear Chemistry*, 20: 43056(T) (JPRS-36943)

conference on nuclear and radiation chemistry, 20: 43356

**NUCLEAR ELECTRIC MOMENTS**

calculation of quadrupole, for first excited state of spherical nuclei, (T), 20: 44812

**NUCLEAR EMULSIONS**

ion track width measurements in, charge determination from thin-down, 20: 43706

mesons ($K^-$) capture in, hyperfragments, hyperons, and meson ($\pi$) production in, 20: 44657 (UCRL-16602)

particle track discrimenation by electron microscopy, 20: 43731

proton interactions at 24 Bev/c, method of analysis of mechanism for inelastic, 20: 44192(T)

scattering in, lateral displacement limit effects on determination of mean multiple Coulomb, (E), 20: 43690

use in neutron dosimetry, 20: 43671 (ORNL-P-2467)

**NUCLEAR ENGINEERING**

materials for, use of plastic, 20: 43471

**NUCLEAR INDUCTION**

use in determining nuclear magnetic moments, comparison with hyperfine structure method, 20: 44695

**NUCLEAR ISOMERS**

formation ratios of, in (n,$\gamma$) reactions with germanium-76 and selenium-82, effects of energy on, 20: 44816

**NUCLEAR MAGNETIC MOMENTS**

determination from hyperfine structure and nuclear induction measurements, accuracy of, 20: 44695

**NUCLEAR MAGNETIC RESONANCE**

classification and analysis of, 20: 44680

detection using modified spectrometer for improving signal-to-noise ratio, 20: 43640

spectra recording of, magnetic-field pulse modulation method for, 20: 43657

use for determination of optical purity of $\alpha$-deuterated primary alcohols, 20: 43254

use for type-II superconductor investigations, 20: 44517(T)

use to determine manganese ion in pyruvate carboxylase, 20: 42773

**NUCLEAR MODELS**

energy levels of medium-weight nuclei, $0^+$, (T), 20: 44647 (NIJS-R-484)

formulation of statistical, (T), 20: 44698

nucleon-phonon interactions in nuclei, (T), 20: 44638 (JINR-E-2772)

parity in asymmetric top, of deformed even-even nuclei, (T), 20: 44781

potentials with local and nonlocal interactions, isospin dependence of, (T), 20: 44691

potentials with local and nonlocal interactions, isospin-dependent, (T), 20: 44844

**NUCLEAR MODELS (SHELL)**

binding energies of s-d shell nuclei, quadrupole correlations in, (T), 20: 44818

description of light nuclei using Brueckner model, nucleon-nucleon interactions in, (T), 20: 44652 (ORNL-P-2468)

energy-level transitions in nuclei with A = 14 to 18, mixing ratios for, (T), 20: 44784

matrix elements for ($1d_{5/2}$, $2s_{1/2}$) configuration in oxygen isotopes, (T), 20: 44749

nucleon interactions in single j-shell with charge-independent pairing force, calculations using BCS method, (T), 20: 44734

nucleon pairing approximation for $f_{7/2}^-$ and $p_{3/2}^+$ shells, (T), 20: 44684

nucleon pairing interactions in translationally invariant, group-theoretical treatment for, 20: 44699

nucleon shells in nuclei with $Z > 82$ and $N > 126$, closed, (T), 20: 44640 (JINR-P-2793)

nucleon shells of nuclei with $N \geq 126$ and $Z \geq 82$, (T), 20: 44774

**NUCLEAR PHYSICS**

data storage systems for nuclear codes, secondary, 20: 43804 (LA-3546)

nuclear data information center, bulletin of IAEA, 20: 44665(T) (INDSWG-101)

research in low-energy, review of, 20: 43764

**NUCLEAR POWER**

development and economics in France, 20: 45166

development and prospects for central-station, in U. S., 20: 45175

development in Canada, industrial effects on, 20: 45245

development program in U. K., 20: 45179

development program and status in U. K., 20: 45179

economics of, fuel cycle effects on, 20: 45099

research on military uses of, in France, 20: 45239(R) (NP-16267)

use in Canada, effect of fossil fuel transportation costs on, 20: 45177

use in expanding utility systems, economics of, 20: 45178

**NUCLEAR POWER PLANTS**

costs of RISE, effect of power conversion efficiency on, 20: 43799 (NP-16281)

development in Israel for sea water desalination, economic and technical advantages for, 20: 45188

development in U. S., economic analysis of, 20: 45175

development of Karachi, status, 20: 45101(R) (66-CNA-305)

economics and prospects for, model analysis of, 20: 45128

economics and status of dual-purpose, 20: 45189

economics of desalination-power, 20: 45187

economics of, for expanding utility systems, 20: 45178

industry in Canada, general survey, 20: 45102 (66-CNA-320)

integration into utility system, problems of, 20: 45182

steam generation in, temperature-enthalpy diagram for analysis of, 20: 45174

use of dual-purpose desalination, for Northeast U. S. water supplies, 20: 45186 (NP-16148)

**NUCLEAR REACTIONS**

book: *Nuclear Chemistry*, 20: 43056(T) (JPRS-36943)

charged-particle spectra from, computer program for decomposition of, 20: 44656 (TID-23315)

cross sections for direct spin dependence of differential, (T), 20: 44773

excitation functions for, errors in fluctuation analysis, (T), 20: 44745

isospin effects in light nuclei, review on, 20: 44834

mechanism and isospin selection rules in light nuclei, involving virtual photons, (T), 20: 44744

model for, heavy-ion-induced transfer, diffraction, (T), 20: 44757

recoil products of, diffusion measurements for determination of, 20: 43073 (JINR-P-2804)

theory of direct, using three-body collision theory, 20: 44654 (PUC-937-227)

theory of, channel coupling in, 20: 44653 (PUC-937-219)

theory of, completeness of set of eigenstates of non-Hermitian operators in, 20: 44707

**NUCLEAR SPIN**

effect on differential cross sections for direct reactions, (T), 20: 44773

**NUCLEAR STRUCTURE**

determination using electron inelastic scattering, review of, 20: 44679
symmetry for, quasi-spin representations of the orthogonal group R(5), 20: 44676

**NUCLEI**

abundances in solar system, mass low dependence on nucleosynthesis, 20: 44070 (LA-DC-7885)
alpha inelastic scattering by even-even 46 ≤ A ≤ 64, vibrational energy levels from, (E/T), 20: 44795
alpha scattering by spherical even-even, quadrupole and octupole energy-level transitions from, (E/T), 20: 44799
beta decay of oriented, nuclear reorientation before gamma emission in, (T), 20: 44688
binding energies, (T), 20: 44703
binding energies of s-d shell, quadrupole correlation in, (T), 20: 44818
description of deformed, using single-particle model with energy-dependent potential, (T), 20: 44830
description of ground state, using random phase approximation, (T), 20: 44766
description using Hartree-Fock approximation with density-dependent two-nucleon interaction, (T), 20: 44785
deuteron elastic scattering by, optical model for, (T), 20: 44846
deuteron reactions (d,p) with even-even spherical, vibrational energy levels from, (E/T), 20: 44797
deuteron reactions and scattering on, isospin effects on, 20: 44834
electron elastic scattering at high energies, phase shifts for, (T), 20: 44675
electron inelastic scattering by light, sum rule for, (T), 20: 44636 (INP-479/PL)
electron inelastic scattering by nuclei, review of nuclear structure determination from, 20: 44679
electron scattering by, cross sections for inelastic, 20: 44208
electron scattering by, solution of Dirac equation using Green functions, (T), 20: 44847
energy levels of A = 37, T = $\frac{3}{2}$ multiplet, (E), 20: 44659 (UCRL-16990)
energy levels of A = 24, T = 2, (E), 20: 44758
energy levels of deformed even-even octupole vibrational, (T), 20: 44825
energy levels of deformed even-even, rotational, (T), 20: 44843
energy levels of even-even, with 228 ≤ A ≤ 254, octupole, (T), 20: 44751
energy levels of even-even, (T), 20: 44788
energy levels of even-even spherical, vibrational, (T), 20: 44797
energy levels of heavy, (γ,n) reactions for studying, 20: 44631 (CONF-660303, pp 1064-72)
energy levels of medium-weight, $0^+$, (T), 20: 44647 (NIJS-R-484)
energy levels of spherical odd-mass, wave functions for collective properties of low-lying, 20: 44742
energy levels of spherical, quadrupole moments of, (T), 20: 44812
energy levels of, lifetime measurements using gamma Doppler shift, (T), 20: 44724
energy levels of, isobaric analogue, (T), 20: 44777
energy levels of, description of rotational, (T), 20: 44810
energy spectra and flux of low-energy heavy, of cosmic radiation, (E), 20: 44458
energy-level transitions in A = 15, mixing ratios of, mirror, (T), 20: 44783
energy-level transitions in even-even spherical, octupole and quadrupole, 20: 44799
fission of, corrections to calculation of fission-fragment yields in, (T), 20: 44819
gamma angular correlations from, testing symmetries by, (T), 20: 44806
gamma elastic scattering by Z = 72 at 92 to 0.511 Mev, (E), 20: 44829
gamma reactions (γ,n) and (γ,p) with medium and heavy, mechanism of, (E), 20: 44778
gamma spectra of neutron-deficient, 20: 44634(R) (IDO-17188)
gyromagnetic ratios of deformed odd-A, 20: 44791
hyperon (Λ) binding energies in, (T), 20: 44702
hyperon (Λ) binding energies in, (T), 20: 44703
mass equations for, semi-empirical, (T), 20: 44814
mesons ($K^-$) capture in, hyperfragments, hyperons, and meson (π) production in, 20: 44657 (UCRL-16602)
model of deformed even-even, parity in asymmetric top, (T), 20: 44781
neutrino quasi-elastic scattering by, (T), 20: 44740
neutron cross sections and resonance integrals for heavy, 20: 44602 (BN[illegible]082)
neutron elastic scattering by Z = 13 to 92, cross sections for, 20: 44669(T) (INDSWG-101, pp 109-57)
neutron inelastic scattering by Z = 3 to 92, cross sections for, 20: 44668(R) (INDSWG-101, pp 73-108)
neutron reactions with charged-particle emission, review on thermal, 20: 44666(T) (INDSWG-101, pp 1-22)
neutron reactions with Z = 13 to 28, with charged-particle emission, 20: 44671(T) (INDSWG-101, pp 164-223)
neutron reactions with Z = 11 to 16, fluctuations in total cross sections for, (E), 20: 44743
neutron resonance parameters for Z = 18 to 95, 20: 44667(T) (INDSWG-101, pp 23-72a)
neutron scattering by, computer program for solving T matrices for, 20: 44663 (WAPD-TM-571)
neutron scattering by, spin-orbit effects in, (T), 20: 44780
nuclear data sheets for A = 186, revised, 20: 44713
nuclear data sheets for A = 187, revised, 20: 44714
nuclear data sheets for A = 188, revised, 20: 44715
nuclear data sheets for A = 189, revised, 20: 44716
nucleon binding energy in, calculation using K-matrix theory, 20: 44727
nucleon interactions in single j-shell with charge-independent pairing force, calculations using BCS method, (T), 20: 44734
nucleon pairing approximation for $f_{7/2}^-$ and $p_{3/2}^+$ shells, (T), 20: 44684
nucleon reactions above $10^{12}$ ev, angular distribution of secondaries from, (E), 20: 44286
nucleon scattering by solution of Schroedinger equation using Green-function method, (T), 20: 44836
nucleon shells in Z > 82 and N > 126, closed, (T), 20: 44640 (JINR-P-2793)
nucleon shells of N ≥ 126 and Z ≥ 82, calculations using diffuse potential well, (T), 20: 44774
nucleon-nucleon interactions in light, (T), 20: 44652 (ORNL-P-2468)
nucleon-nucleon interactions in, (T), 20: 44760
nucleon-phonon interactions in, (T), 20: 44678
production in neutron stars, neutron and proton chemical potentials for, 20: 44074
proton elastic and inelastic scattering by, analogue-state resonances in, (T), 20: 44796
proton elastic scattering by, interference effects in Coulomb and nuclear polarized, (T), 20: 44741
proton scattering by A = 44 to 74, isobaric analogue states from, (E), 20: 44761
proton total cross sections of Z = 4 to 92 at 99 Mev, (E), 20: 44687
reaction mechanism in light, involving virtual photons, (T), 20: 44744
reactions with protons at 24 Bev in strong pulsed magnetic field, quasi-nucleon interactions in, 20: 44280
rotation of, current and magnetic field from, (T), 20: 44833
stability of, neutron excess effects on equilibrium, (T), 20: 44674
wave functions for three-body, orthonormal expansion of, (T), 20: 44692

**NUCLEI (CELLS)**

injuries to mouse bone marrow and spleen, from x rays in combination with acceleration or vibrations, 20: 42986
modification of rat thyroid, during β-induced neoplasia, 20: 42857(R) (TID-23228)
preparation of amoeba, for toxicity test systems, 20: 42997(R) (ANL-7136, pp 191-204)
properties of proteins in, 20: 42702(R) (ANL-7136, pp 243-55)
protective effects of post-irradiation oxygen starvation against injuries to, in rat thymocytes exposed to x rays, 20: 42989
radiation effects on volume of *Paramecium caudatum* macro-, uv, 20: 42800(T) (ORNL-tr-1289)
radiation effects on human thyroid β and x, 20: 42857(R) (TID-23228)
radiation effects on thymocyte, effects of phosphate metabolism and respiration on x, 20: 42928
radioinduced pyknotic degeneration of retinal, x, 20: 42958

**NUCLEONS**

binding energy in nuclei, calculation using K-matrix theory, 20: 44727
form factors for, electric and magnetic, (T), 20: 44269
form factors for, from singularities in redundant variables of sum rules, 20: 44362
interactions in nuclei, pairing approximation for $f_{7/2}^-$ and $p_{3/2}^+$ shells, (E), 20: 44684
interactions in nuclei, (T), 20: 44844
interactions in single nuclear j-shell with charge-independent pairing force, calculations using BCS method, (T), 20: 44734
interactions of, lower energy bound for form factor decay for large momentum transfer in, (T), 20: 44257
interactions with nucleons in light nuclei, (T), 20: 44652 (ORNL-P-2468)
interactions with phonons in nuclei, (T), 20: 44638 (JINR-P-2772)
interactions with phonons in nuclei, (T), 20: 44678
interactions with nucleons, effects of strong correlations on weak, (T), 20: 44760
interactions with electrons, particle production from inelastic, (T), 20: 44180
interactions with mesons (π), P-wave resonances in Chew-Low model for, 20: 44186
interactions with nucleons, phase-shift analysis of, (E/T), 20: 44191(T)
interactions with mesons (π) at high energies, polarization in charge-exchange, (T), 20: 44201

interactions with nucleons, S-matrix theory for nonrelativistic, 20: 44209
interactions with photons near threshold, meson production in, (T), 20: 44211
interactions with nucleons, $\rho'$ trajectory contribution to charge-exchange, 20: 44222
interactions with photons, quark model for baryon resonance and meson production from, 20: 44239
interactions with nucleons at low energies, two-meson ($\pi$) exchange potential in, (T), 20: 44271
interactions with deuterons, differential cross sections for inelastic, (T), 20: 44275
interactions with neutrinos ($\nu_\mu$), polarized $N^*$ production from, (T), 20: 44276
interactions with protons in emulsions at 24 Bev in strong, pulsed magnetic field, 20: 44280
interactions with mesons ($\pi$), general solution of Chew-Low equations for partial waves in, 20: 44281
interactions with mesons ($\pi$) at high energies, backward and forward peaks for elastic, (T), 20: 44267
pairing interactions in translationally invariant shell model, group-theoretical treatment of, 20: 44699
reactions with carbon and lead, cascade showers from, (T), 20: 44152
scattering of, solution of Schroedinger equations using Green-function method, (T), 20: 44836

**NUCLEOSIDES**
content in urine of irradiated rats, 20: 42807
effects on thymine utilization by *E. coli*, 20: 42716(R) (UCRL-16246, pp 164-7)

**NUCLEOTIDES**
radiation effects on bone marrow concentration, ionizing, 20: 42822
radiation effects on rat blood, whole-body x, 20: 42955

**NUCLEOTIDES, PYRIDINE DIPHOSPHATE**
radiation effects on metabolism of, in rat bone marrow and peripheral blood, x, 20: 42788
reduction mechanisms in rat liver slices, 20: 42759
relation to sodium ion efflux from rat liver slices, 20: 42758

**NUCLEOTIDES, PYRIDINE TRIPHOSPHATE**
radiation effects on metabolism of, in rat bone marrow and peripheral blood, x, 20: 42788
relation to sodium ion efflux from rat liver slices, 20: 42758

**NUTRIENTS**
content in Mediterranean Sea, 20: 43508(R) (NP-16179)
effects of starvation on life span of mice, 20: 42840(R) (ANL-7136, pp 164-90)

## O

**OAK RIDGE NATIONAL LAB., TENN.**
waste disposal at, liquid, 20: 45216 (ORNL-3721)

**OATS**
calcium uptake and distribution in, relation to strontium-90, 20: 42766
radioinduced calcium release in coleoptiles of, and subsequent effects on texture, 20: 42815
strontium-90 uptake and distribution in, relation to calcium, 20: 42766

**OILS**
interface with water in rocks, determination of, 20: 43553

**OLEIC ACID, METHYL ESTER**
separation of labeled, tritium—carbon-14 isotope effects in chromatographic, 20: 43394

**OLEIN**
metabolism of iodine-131-labeled, age effects on, 20: 42782

**OLFACTORY ORGANS**
radiosensitivity effects of olfactory bulb in pigeons and rats, 20: 42852(R) (ORO-2903-28)

**OLIGOMYCIN**
effects on sodium ion efflux from rat liver slices, 20: 42758

**OLIVINES**
content in water insoluble fraction from Gnome shot in salt horizon, 20: 43464
use in localizing fission products in underground explosions, 20: 43464

**ONIONS**
radioinduced inhibition of sprouting of, 20: 43781

**OREGON**
zinc-65 distribution in plankton from offshore waters of, 20: 43545

**ORES**
analysis by bremsstrahlung activation methods, 20: 43119
correlation and chronology of deposits of, research program on, 20: 43500(R) (COO-689-60)

**ORGANIC ACIDS**
determination of carbon-14-labeled, from plant material and silage by liquid scintillation counting, 20: 43125
separation from plant material and silage by chromatography, 20: 43125
yields in irradiation of hydrocarbon and carbon dioxide mixtures, 20: 43333

**ORGANIC COMPOUNDS**
analysis for uranium, extraction-fluorophotometric, 20: 43071 (IDO-14679, pp 75-191)
electric-dipole transitions in, operator for spin-forbidden, 20: 44124
radioinduced cationic polymerization of, review on, 20: 43292 (ORO-2968-21)
radiolysis of, correlation of structural unit with G values of products from gamma, 20: 43296

**ORGANIC COOLED REACTORS**
fuel cycle optimization for heavy-water-moderated, 20: 45185

**ORIFICES**
pressure drop for, in gas bearings, 20: 43469 (TID-23350)

**ORNL HIGH FLUX ISOTOPE REACTOR**
design of, 20: 45205 (ORNL-P-2491)
filtration system for iodine retention at, in-place testing of, 20: 43584 (ORNL-P-2411)
materials for use in, dynamic corrosion testing of, 20: 43833 (ORNL-TM-1030)
operation, 20: 45205 (ORNL-P-2491)
target element fabrication for, equipment development for, 20: 45204 (ORNL-P-2410)

**OROTIC ACID**
radioprotective effects on leukopoiesis in rabbits and rats, 20: 42937

**OSMIUM**
separation from other elements by ion exchange using triisooctylamine, 20: 43439

**OSMIUM ISOTOPES**
energy levels of, rotational, (T), 20: 44843
separation of, chemical purification following electromagnetic, 20: 43801

**OSMIUM ISOTOPES Os-186**
energy levels of, octupole vibrational, (T), 20: 44825
nuclear data sheets, 20: 44713

**OSMIUM ISOTOPES Os-187**
nuclear data sheets, 20: 44714

**OSMIUM ISOTOPES Os-188**
energy levels of, octupole vibrational, (T), 20: 44825
nuclear data sheets, 20: 44715

**OSMIUM ISOTOPES Os-189**
nuclear data sheets, 20: 44716

**OSMIUM ISOTOPES Os-190**
energy levels of, octupole vibrational, (T), 20: 44825

**OSMIUM ISOTOPES Os-192**
energy levels from decay of iridium-192, (E), 20: 44700

**OSMOSIS**
radiation effects on regulation in fish, x, 20: 42885

**OUABAIN**
effects on reduction of pyridine nucleotides in rat liver slices, 20: 42759
effects on sodium ion efflux from rat liver slices, 20: 42758
effects on sodium ion efflux from rat liver slices, 20: 42759

**OXIDATION**
measurement of, use of Kryptonate beta sources in, 20: 43765
rate constants for, of metals, computer program for, 20: 43172 (NAA-SR-Memo-11966)

**OXIDES**
recrystallization and sintering of, studies, 20: 43813(R) (COO-1122-3)

**OXONIUM IONS**
reactions of monovalent, with dinonylnaphthalenesulfonic acid, effects of diluent on, 20: 43447

**OXYGEN**
atomic density measurements in afterglow plasma of, 20: 44852 (AD-629924)
content in spleen of irradiated rats, effects of barbamyl and serotonin on, 20: 43008
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in aluminum and aluminum alloys by activation methods, 20: 43155
determination in industrial and natural water, radiochemical method for, 20: 43064 (EUR-2991.f)
determination in reactor blanket gas, design of continuously operating gas chromatogram for, 20: 43157
determination in sodium, device for interference reduction and sensitivity improvement in activation, 20: 43075 (LA-DC-7931)
determination in steels, instrument for neutron activation methods of, 20: 43160
determination in steel by x-ray spectrochemical methods, 20: 43161
determination in titanium, activation, 20: 43111
determination of, in potassium and sodium by emission spectrography, 20: 43083 (R-66SD3012)
determination of, in gases by deuteron irradiation and neutron time-of-flight spectroscopy, 20: 43115
determination of, in titanium oxides by proton activation analysis,

20: 43127
diffusion in alumina–nickel and TD nickel at high temperatures, 20: 43845(R) (AD-637573)
effects on chlorination of uranium (IV) oxide, 20: 43443
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
effects on gamma-induced inactivation of transforming DNA, 20: 42818
effects on niobium–vanadium alloy ductile-to-brittle transitions, 20: 43893 (KAPL-3119)
effects of radioinduced polymerization of styrene, 20: 43338
effects on strain-aging in tantalum, 20: 43922
effects on surface properties of beta-phase annealed zirconium, 20: 43933
ignition of irradium in, mechanisms of, 20: 43611
ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122
meson ($\pi^-$) capture by, helium-8 production by, (E), 20: 44770
metabolism in mouse radiation chimeras, effects of heterologous and isologous bone marrow grafts on, 20: 42854(R) (TID-23127)
neutron cross sections from 0.037 ev to 18 Mev, tables of, 20: 44661 (UNC-5139)
proton reactions at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
radiation effects on reactions of, with nitrogen, electron and ion recombinations in, 20: 43354
radiosensitivity effects on *Escherichia coli*, uv, 20: 42838(R) (ANL-7136, pp 140-54)
reactions with hafnium borides and zirconium borides at 1200 to 2000°K, kinetics of, 20: 43840
reactions with uranium at 300 to 625°C, kinetics of, 20: 43841
reactions with uranium-base aluminum and copper alloys, kinetics at 300 to 625°C, 20: 43841
reactions with uranium tetraiodide and triiodide, kinetic studies of, 20: 43194
separation from thorium by electrotransport, 20: 43820

**OXYGEN IONS**
energy in ionosphere, thermal conduction effects on, 20: 44430
reactions of nitric oxide with atomic and molecular, charge transfer, 20: 44127

**OXYGEN ISOTOPES**
determination in inorganic phosphates using mass spectrometry, 20: 43146
energy levels of, calculations using shell model, (T), 20: 44749

**OXYGEN ISOTOPES O-16**
content in Bosumtwi Crater glass, moldavites, and tektites, 20: 43511
description using Hartree-Fock approximation with density-dependent two-nucleon interaction, (T), 20: 44785
deuteron reactions (d,p) at 6.00 to 8.55 Mev, oxygen-17 energy levels from, (E), 20: 44835
energy levels from electron inelastic scattering, (E), 20: 44769
energy-level transitions in, mixing ratios for, (T), 20: 44784
energy-level transitions in rotational bands, (E), 20: 44776
gamma reactions ($\gamma$,n), cross sections for, (E), 20: 44660 (UCRL-70002)
meson ($\pi$) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
muon capture by, irregular G-parity interaction in, (T), 20: 44767
neutron scattering at 3 to 4 Mev, (E), 20: 44651 (ORNL-P-2434)
reactions (O-16, N-15) with boron-11 at 27 to 35 Mev, (E/T), 20: 44757

**OXYGEN ISOTOPES O-17**
determination in gases, by proton irradiation and neutron time-of-flight spectroscopy, 20: 43115
energy levels from oxygen-16 (d,p) reactions at 6.00 to 8.55 Mev, (E), 20: 44835
energy levels of, calculations using shell model, (T), 20: 44749
spectra in enriched heavy and light water, effects of temperature on NMR, 20: 43171 (LA-DC-7394(Rev.))
spectra of, incorporated in benzoquinone, effects of solvents on ESR, 20: 43224

**OXYGEN ISOTOPES O-18**
content in Bosumtwi Crater glass, moldavites, and tektites, 20: 43511
determination in gases, by proton irradiation and neutron time-of-flight spectroscopy, 20: 43115
determination in ground and surface water, 20: 43531
deuteron reactions (d,$\alpha$) at 11.98 Mev, nitrogen-16 energy levels from, (E), 20: 44730
effects on infrared spectra of glycine, 20: 43283
energy levels of, calculations using shell model, (T), 20: 44749
enrichment in sea water by evaporation, 20: 43509
exchange between phenols or quinone and water in acidic media, mechanisms of, 20: 43276

**OXYGEN ISOTOPES O-19**
energy levels of, calculations using shell model, (T), 20: 44749

**OXYGEN ISOTOPES O-20**
energy levels of, calculations using shell model, (T), 20: 44749

**OXYGEN SYSTEMS**
Am–O, phase studies, 20: 43811(R) (BNWL-269, pp 1.1-28)
C–Nd–O, preparation and properties of $Nd_2O_2C_2$ in, 20: 43214
Nb–O–W, crystal structure of $Nb_{16}W_{18}O_{94}$ in, 20: 43188
O–Pr, phase studies of, at 0 to 1 atm and 200 to 1150°C, 20: 43967
O–Ta–W, crystal structure of $Ta_{16}W_{18}O_{94}$ in, 20: 43188

**OZONE**
content in uv irradiation rooms, 20: 43011
production of, development and economics of chemonuclear processes for, 20: 43300

# P

**PACIFIC OCEAN**
analysis for copper, manganese, and zinc in Southeastern, activation, 20: 43085(R) (TID-23295, Sect.2)
ecology of Northeast, 20: 42731(R) (RLO-1751-2)
strontium-90 content of, evaluation of total, 20: 43517(T) (AEC-tr-6798, Paper 2)
strontium-90 content and diffusion in, 20: 43541
strontium-90 distribution on surface of, compared to Atlantic and Indian Oceans, 20: 43516(T) (AEC-tr-6798, Paper 1)
zinc-65 distribution in plankton from, near Columbia River mouth, 20: 43545

**PACKAGING**
effects of polythene, on toxin production by *Clostridium botulinum*, type E, on gamma irradiated fish, 20: 43779

**PALLADIUM**
determination by charged-particle reactions at 2 Mev, 20: 43097
deuterium–hydrogen isotopic exchange in, effects of pressure and temperature on, 20: 43236
diffusion of deuterium and hydrogen in, 20: 43934
diffusion of deuterium and hydrogen in, effects of pressure and temperature on, 20: 43935
diffusion of deuterium and hydrogen in, effects of pressure and temperature on, 20: 43935
effects on hydrogenation of deuterated and normal substituted ethylenes, mechanism of catalytic, 20: 43279
electron reactions at 18 Mev, anomalous secondary electron emission from, 20: 44117
photoelectric and optical properties of films of, in extreme ultraviolet, (E), 20: 44995 (ORNL-TM-1392)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439

**PALLADIUM ALLOYS**
Pd–Ag, diffusion of deuterium and hydrogen in, 20: 43934
Pd–Ag, diffusion of deuterium and hydrogen in, effects of pressure and temperature on, 20: 43935
Pd–Rh, diffusion of deuterium and hydrogen in, 20: 43934
Pd–Sn, diffusion of deuterium and hydrogen in, 20: 43934

**PALLADIUM HYDRIDES**
hydrogen–deuterium equilibration over, effects of hydrogen content on, at −195 to −183°C, 20: 43232

**PANCREAS**
radiation effects on zinc content, x, 20: 42917

**PARAMECIUM**
radiation effects on content of DNA and RNA in, uv, 20: 42800(T) (ORNL-tr-1289)
radiation effects on cultures of, natural ionizing, 20: 42886

**PARASITES**
effects on metabolism of mice, 20: 42854(R) (TID-23127)
radiation effects on development of *Ascaridia galli* in chickens, x, 20: 42968

**PARATHYROID GLANDS**
radioisotope scanning techniques for, 20: 43051

**PARTICLE COLLECTORS**
development of gas-particulate, for LOFT program, 20: 43067(R) (IDO-14679, pp 6-46)
use for sampling ragweed pollen, 20: 45235 (BNL-957)

**PARTICLE STATISTICS**
size distributions, in samples, 20: 42698(R) (ANL-7136, pp 80-94)

**PARTICLES**
abundance in relation to antiparticles in universe, 20: 44097
deposition in gas-cooled reactors, counting, sizing, and sampling of Aitken, 20: 45055
interactions of, kinematic laws and invariance for, 20: 44033
production of neutral, energies of sputtered, 20: 44139
size determination of plutonium, in air at Rocky Flats, Colorado, 20: 43595
spin models for, field equations for relativistic, 20: 44481

**PATHOLOGY**
effects of nuclear blast on biological-system, 20: 42710 (TID-23348)

**PEACH BOTTOM POWER REACTOR**

description of, 20: 45170
**PEAS**
calcium uptake and distribution in, relation to strontium-90, 20: 42766
radiation processing of, effects on color, flavor, and texture, 20: 43781
strontium-90 uptake and distribution in, relation to calcium, 20: 42766
**PECTINS**
radioinduced degradation of apple, γ, 20: 42851(R) (NYO-3274-9)
**PEGMATITES**
age of estimation, by argon-potassium method, 20: 43504(R) (COO-689-60, App.A-4)
uranium content, 20: 43564
**1,3-PENTADIENE**
radioinduced polymerization of, ESR studies of free radicals from electron, 20: 43325
**2,4-PENTANEDIONE COMPLEXES**
with uranium, reduction and dismutation of, polarographic studies on, 20: 43205
**PENTANES**
radioinduced carboxylation of, gamma and x, 20: 43333
**2-PENTANONE**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
**3-PENTANONE**
hydrogen abstraction from, by *tert*-butoxy radicals, effects of deuterium on, 20: 43284
**3-PENTANONE, 2,4-DIMETHYL-**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
**2-PENTANONE, 4-METHYL-**
effects on solvent properties of organic phosphorus acids for di- and trivalent americium, europium, and thulium ions, 20: 43445
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
**3-PENTANONE, 2,2,4,4-TETRAMETHYL-**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
**1-PENTENE**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**1-PENTENE, 2-METHYL-**
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
**2-PENTENE, 3-METHYL-**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**PEPTIDES**
radiation effects on splitting of, from myoglobins, gamma, 20: 42799(R) (UCB-34P95-1)
**PERCHLORIC ACID**
effects of aqueous solutions of, on reactions of europium with chromium and vanadium, 20: 43228
effects on chemical properties of pentavalent protactinium, 20: 43431
effects on disproportionation of uranium, 20: 43067(R) (IDO-14679, pp 6-46)
effects on hydrolysis of cerium(IV), spectrometric determination of, 20: 43189
separation of uranium (VI) from, by solvent extraction using thenoyltrifluoroacetone and trioctylamine, 20: 43440
**PEROXIDASES**
horseradish, inactivation of t-RNA from *E. coli* by, 20: 42809
**PEROXIDES**
determination in reactor loop-water samples, titrimetric, 20: 43071 (IDO-14679, pp 75-191)
effects on atherosclerosis, 20: 42813
**PERSONNEL**
health hazards to, manufacturing plutonium oxide/uranium oxide reactor fuel, 20: 43630
maximum permissible concentration of thoron and daughters in air of working premises for, 20: 43603
medical examination of radiation workers, 20: 43600
medical management of beryllium processing plant, 20: 42756
mortality studies on AEC contractor employees exposed to radiation, 20: 42865
neutron dosimetry methods for, 20: 43671 (ORNL-P-2467)
protective clothing for reactor-maintenance, 20: 43575 (CONF-660621-1)
qualifications of brazing and welding, 20: 43821
radiation dose from occupational exposure in German Democratic Republic, 1964, 20: 43614
radiation exposure dose calculations during therapy using radium-224, radium-226 and thorotrast, 20: 43046
radiation hazards to radioisotope, ventilation systems for reducing, 20: 43593(T) (AEC-tr-6642)
water shielding for cobalt-60 well irradiator, 20: 43613
**PETROLEUM**
economics of, for generating electric power, 20: 45242 (TID-22978(Rev.))
radiation-thermal cracking of low-octane-number, straight-run gasoline, in uniform temperature field, 20: 43336(T)
recovery and storage of, use of underground explosions in, 20: 43463 (UCRL-14756)
transportation costs in Canada, 20: 45177
**PHANTOMS**
design for γ- and x ray dosimetry, 20: 43053(P)
determination of gonadal radiation dose in, 20: 43026
dose calculations of radium implants in cranium, 20: 43616
effects of tissue depth in lucite, on RBE of 35-Mev electron beams in mice, 20: 42974
radiation dose distribution in pharyngeal, x, 20: 43020
use for dosimetry of scattered electrons and x rays from therapeutic electron beam, 20: 43012 (BMwF-FBK-66-03)
use in bone density measurements by gamma radiography, 20: 43049
use in calibration of equipment for measuring thyroid radioiodine uptake, 20: 43031
use of human, for determining quantitative distribution of bone marrow in irradiated areas, 20: 43620
**PHARYNX**
radiotherapy of cancers of, radium and x, 20: 43042
radiotherapy of cancers of, technique and dose distribution of x, 20: 43020
radiotherapy of skin metastases arising from neoplasms in, 20: 43039
**PHASE STUDIES**
equilibria at high temperatures, bibliography on, 20: 43903 (NP-16238)
transformation under pressure, mechanisms of plutonium alpha ⇄ beta, 20: 43953
**1,10-PHENANTHROLINE**
analytical use in colorimetric determination of iron, 20: 43067(R) (IDO-14679, pp 6-46)
use in colorimetric determination of iron, 20: 43071 (IDO-14679, pp 75-191)
**PHENATINE**
effects on acceleration tolerance in mice and guinea pigs, 20: 43004
**PHENAZINE**
deuterium exchange between, and ammonia, effects of ring position on, 20: 43216
**PHENOL**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
radiolysis of, water elimination reactions in pulse, 20: 43332
**PHENOL, p-BROMO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
**PHENOL, p-CHLORO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
**PHENOL, DINITRO-**
effect on repair of radioinduced chromosome breaks in *Vicia faba*, 20: 42913
effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775
**PHENOL, NITRO-**
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
**PHENOLS**
oxygen-18 exchange between, and water in acidic media, mechanisms of, 20: 43276
**PHENOTHIAZINES**
effects on acceleration tolerance of mice and guinea pigs, 20: 43004
**PHENYL ETHER**
biphenyl–biphenyl ether, performance as working fluid in Rankine cycle, 20: 43497(R) (SAN-651-1)
**p-PHENYLENEDIAMINE, N,N,N',N'-TETRAMETHYL-**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**PHONONS**
dispersion in liquid nitrogen, cold neutron scattering studies of, (E), 20: 44598
interactions with electrons in indium, coupling from, 20: 44553
interactions with nucleons in nuclei, (T), 20: 44638 (JINR-E-2772)
interactions with nucleons in nuclei, (T), 20: 44678
**PHOSPHATASES**
radiation effects on properties, alkaline, in solutions, γ, 20: 42819
**PHOSPHATES**
effects on radiation damage in thymocyte nuclei, x, 20: 42928
uptake by parasitic plants and hosts, tracer study, 20: 42850(R) (NYO-2043-130)
**PHOSPHATIDES**
chemical structure of blood serum, 20: 42743 (UCRL-14631)
radiation effects on metabolism of, gamma, 20: 42796
**PHOSPHINE**
radiation effects on monosilane production in, recoil silicon atom reactions in neutron, 20: 43315
$PH_3$–$SiH_4$, radiation effects on di- and monosilane production in,

- recoil silicon atom reactions in neutron, 20: 43315

**PHOSPHINE OXIDE, BIS(1-AZIRIDINYL)-(HEXAHYDRO-1*H*-AZEPIN-1-yl)-**
- use as chemosterilant for screw-worm flies, comparison with γ irradiation, 20: 42724

**PHOSPHINE OXIDE, TRIOCTYL-**
- complexes with rare earths, preparation and properties of, 20: 43100
- solvent properties for rare earths, 20: 43100

**PHOSPHINE SULFIDE, TRIS(1-AZIRIDINYL)-**
- effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775

**PHOSPHOMOLYBDATES**
- calcination of solutions of, effects of aluminum, calcium, and iron nitrates on, 20: 43186(T) (ORNL-tr-1344)

**PHOSPHONIC ACID, (2-ETHYLHEXYL)-**
- solvent properties for di- and trivalent americium, europium, and thulium, 20: 43445

**PHOSPHONIC ACID, VINYL-**
- radioinduced graft polymerization of dichloranhydride of, on fiber glass, silica gel, and zirconium oxide, 20: 43311

**PHOSPHONIUM COMPOUNDS**
- triphenyl-, with rare earths, preparation and properties of, 20: 43231

**PHOSPHORIC ACID**
- radiation effects on, in mitochondria, gamma and x, 20: 42866

**PHOSPHORIC ACID, BIS(2-ETHYLHEXYL) ESTER**
- bis(2-ethylhexyl) phosphate–heptane, solvent properties for americium, 20: 43072(R) (IDO-14679, pp 193-229)
- solvent properties for di- and trivalent americium, europium, and thulium, 20: 43445

**PHOSPHORS**
- chemistry and physics of, conference on, 20: 45044
- neutron multiple scattering at 1 to 500 kev in boron-10 glass, Monte Carlo methods for studying fast, 20: 43700
- performance in scintillation spectrometry, review of, 20: 43096
- radiation effects on, 20: 45044
- resolution and response of thallium-activated sodium-iodide crystals, for electrons, 20: 43704
- response of organic NE-213, to neutrons at 0.1 to 20 Mev, 20: 43672 (ORNL-P-2471)

**PHOSPHORUS**
- determination as molybdivanadophosphoric acid, spectrophotometric, 20: 43071 (IDO-14679, pp 75-191)
- determination by charged-particle reactions at 2 Mev, 20: 43097
- effects of dietary, on strontium-85 retention in swine, 20: 42739(R) (COO-1339-3)
- metabolism in *Vicia faba* plants, effects of gibberellic acid on, tracer study, 20: 42771
- neutron total cross section from 5.0 to 8.5 Mev, fluctuations in, (E), 20: 44743

**PHOSPHORUS ISOTOPES**
- fixation by muds, 20: 43544

**PHOSPHORUS ISOTOPES P-28**
- mass from threshold energy for silicon-28 (p,n) reactions, (E), 20: 44812

**PHOSPHORUS ISOTOPES P-29**
- energy levels from silicon-28 (p,γ) reactions, (E), 20: 44790

**PHOSPHORUS ISOTOPES P-31**
- proton reactions (p,γ) at 0.8 to 1.16 Mev, sulfur-32 energy-level transitions from, (E), 20: 44822

**PHOSPHORUS ISOTOPES P-32**
- content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
- determination in biological materials by liquid scintillation counting, combustion methods for, 20: 43128
- distribution in rat tissues after inhalation or oral administration, 20: 42783
- effects of internally deposited, on rat leukocytes, 20: 42948
- effects of subcutaneously injected, on oral tissues of experimental animals, 20: 42967
- effects on erythropoietic index and iron content in man, 20: 42908
- effects on leukemia, therapeutic, 20: 43014(R) (RLO-581-10, pp 33-6)
- effects on polycythemia, therapeutic and leukemogenic, 20: 43014(R) (RLO-581-10, pp 33-6)
- incorporation in Malathion and Parathion, 20: 43397
- preparation of carrier-free, method for, 20: 43389
- production of, review of methods for, 20: 43399
- radiation effects on uptake by tumors injected with 5-bromodesoxyuridine, 20: 42776
- removal of, from rat skin by ultrasonics, 20: 42811
- tracer use in DNA metabolism studies, 20: 42777
- use in radiodiagnosis, 20: 42796
- use in species specificity of reannealed animal DNA, 20: 42757
- use in therapy of acute leukemia, 20: 43045

**PHOSPHORUS SYSTEMS**
- Cr–Ni–P, radiation effects on AWS BNi-7 braze, in-reactor, 20: 44027

**PHOSPHORYLATION**
- inhibition of oxidative, in irradiated rabbits using liver lipids, 20: 42825
- oxidative, relation to sodium ion efflux from rat liver slices, 20: 42758
- oxidative, ultraviolet radiation effects in *Mycobacterium phlei*, 20: 42810

**PHOTOCHEMISTRY**
- induction of carbohydrate utilization in plants by, 20: 42706(R) (NYO-2373-1)

**PHOTOGRAPHIC FILM**
- processing of bubble chamber, description of optical computer system for, 20: 43676

**PHOTOGRAPHIC FILM DETECTORS**
- use in neutron dosimetry, 20: 43671 (ORNL-P-2467)

**PHOTOGRAPHY**
- radioinduced image restoration in, neutron, 20: 43344

**PHOTOMULTIPLIER TUBES**
- dark currents of nitrogen-cooled, with antimony-cesium photocathodes, 20: 43723
- design and performance of 56 AVP Mullark and 9594 E.M.I., for use with scintillation detectors, 20: 43746
- design of, with uv sensitivity, 20: 43727
- sensitivity of nitrogen-cooled, with antimony-cesium photocathodes, 20: 43723
- testing of, dismountable pulse tube for nanosecond techniques for, 20: 43644
- time resolution of 56 AVP, utilizing hydrogen spark light pulse generator, 20: 43709
- use for detection of intermittent light pulses, 20: 43722

**PHOTONS**
- electromagnetic vertex from photodisintegration reactions, inelastic, 20: 44208
- interactions at high energies, differential and total cross sections for intermediate vector boson pair production from, (T), 20: 44277
- interactions with protons, Regge-pole model for $X^0$ (958) production in, (T), 20: 44204
- interactions with nucleons near threshold, meson production in, (T), 20: 44211
- interactions with electrons at high energies, amplitude for backward Compton, (T), 20: 44234
- interactions with nucleons, quark model for baryon resonance and meson production from, 20: 44239
- interactions with protons, Reggeized vector meson exchange for meson ($\pi^0$) production in, (T), 20: 44240
- interactions with protons at 1.36 to 3.0 Bev, single meson ($\pi^0$) production from, (E), 20: 44242
- interactions with protons, absorptive corrections for $N^*$ production in, (T), 20: 44278
- interactions with baryons, $\frac{1}{2}^+$ baryon currents from, (T), 20: 44350
- interactions with mesons, covariant field theoretical calculations of currents from, 20: 44353
- properties of, corpuscular wave, (T), 20: 44185
- reactions with helium-3 at 12 to 170 Mev, nucleon angular distributions and energies from, (E), 20: 44711(T)
- scattering in Rayleigh atmosphere scalar, transfer functions for, 20: 44075

**PHOTOSENSITIVITY**
- action spectrum for *Myxococcus xanthus*, 20: 42842(R) (ANL-7136, pp 290-301)
- effects of centrifugation on plant, 20: 42703(R) (ANL-7136, pp 302-14)

**PHOTOSYNTHESIS**
- factors affecting, in plants in Eastern Mediterranean Sea, 20: 43508(R) (NP-16179)

**PHTHALIMIDES**
- 1,2,3,6-tetrahydro-, dioxime of, analytical uses and reactions of, 20: 43095

**PHTHALOCYANINES**
- complexes with fission products, neptunium, and plutonium, use of, in separation processes, 20: 43153
- localization of cobalt phthalocyanine tetrasulfonate in mouse tumors, 20: 42840(R) (ANL-7136, pp 164-90)

**PHYSICS**
- research programs on, in France, 20: 45239(R) (NP-16267)
- research programs at Chalk River on, 20: 45234 (AECL-2460)
- research reactor uses in, 20: 45206 (ORO-3191-1)

**PHYSIOLOGY**
- effects of nuclear blast on biological-system, 20: 42710 (TID-23348)
- radiation effects on, of stored fruits and berries, gamma, 20: 43782

**PHYTOHEMAGGLUTININ**
- effects on proliferation of cultured human lymphocytes, inhibition by x radiation, 20: 42872

**PICOLINE**
- deuterium exchange between, and ammonia, kinetics of, 20: 43216

**PIEDMONT BELT**
- aerial survey of Denver, Colo., area, γ, 20: 43513 (CEX-59.4.26)

**PIGMENTS**

radiation effects on melanin distribution in fish, γ, 20: 42905
sorption and retention of iodine vapors on, 20: 45045(R) (BMI-X-10173)

**PILOCARPINE**
radiation effects on reactivity of rat intestine to, 20: 42964

**PINCH EFFECT**
dynamics of plasma sheath prior to cumulation, (E), 20: 44872(T) (LA-tr-66-58)
resonance conditions for maximum velocity, (T), 20: 44895

**PIPE FITTINGS**
flexibility of nozzles in spherical shells, 20: 43468 (TID-23344)

**PIPES**
charged-particle motion in conducting, electric and magnetic fields from, (T), 20: 44052
fabrication and installation of, for LCBWR, 20: 45119 (SWRI-1228-7-34)
fabrication and installation for Transuranium Processing Plant, 20: 43425 (ORNL-P-2406)
system design, effect of flexibility of nozzles in spherical heads on, 20: 43468 (TID-23344)

**PIPETTES**
design of remotely operated, for use with radioactive solutions, 20: 43077 (NP-16214)

**PITCHBLENDES**
separation of metals from residues of, leaching processes for, 20: 43420 (MCW-1508)

**PITOT TUBES**
use in plasma stagnation pressure measurements, (E), 20: 44879

**PITUITARY GLAND**
irradiation of human, techniques for alpha, 20: 43017(R) (UCRL-16246, pp 66-73)
radioinduced ablation of, relation of dose in time to alpha, 20: 43016(R) (UCRL-16246, pp 58-65)
radiotherapy of, effects on metabolism of calcium-47 and strontium-85 of alpha, 20: 42744(R) (UCRL-16246, pp 19-35)

**PLAGUE**
epidemiology, control, and treatment of, assessment for civilian defense planning, 20: 43587 (RM-4968-TAB)

**PLANKTON**
ecology and primary production by, in Eastern Mediterranean Sea, 20: 43508(R) (NP-16179)
ecology of Eastern Mediterranean Sea, 20: 43508(R) (NP-16179)
ecology of Northeast Pacific Ocean, tracer study, 20: 42731(R) (RLO-1751-2)
radioactivity in samples from Adriatic and Ligurian Seas, 20: 43536
seasonal variations in Ligurian Sea, 20: 42734
zinc-65 distribution in, from offshore waters of Oregon and Washington, 20: 43545

**PLANT CELLS**
radioinduced chromosome aberrations, gamma and proton, 20: 42898
radioinduced permeability to water of, γ, 20: 42851(R) (NYO-3274-9)

**PLANT METABOLISM**
radiation effects on apples and carrots, γ, 20: 42851(R) (NYO-3274-9)

**PLANT PHYSIOLOGY**
radiation effects on, in Coleus, squash seedlings, and Xanthium, light, γ, and x, 20: 42842(R) (ANL-7136, pp 290-301)
radiation effects on apples and carrots, γ, 20: 42851(R) (NYO-3274-9)

**PLANTS**
analysis for metals, activation, 20: 43060 (CEA-R-2967)
analysis of sagebrush, for mercury, colorimetric and spectrophotometric, 20: 43067(R) (IDO-14679, pp 6-46)
carbohydrate utilization in, induced by light, 20: 42706(R) (NYO-2373-1)
cesium-137 content in fodder, relation to content in reindeer, 20: 42736
cesium-137 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
cultivation methods for *Arabidopsis*, greenhouse and test tube, 20: 42900
decontamination of surfaces of, effects of surface-active agents on, 20: 43579 (INR-725/XXII/C)
effects of gravity on development and growth of corn and oat during satellite motion, 20: 42703(R) (ANL-7136, pp 302-14)
effects of soil organic matter on metabolism, 20: 42795
effects of space flight on chromosome aberrations in roots of, 20: 42909
genetics of *Manihot esculenta*, 20: 42850(R) (NYO-2043-130)
hazards to, from radioactive contamination of surface waters, 20: 43598
phosphate metabolism in parasitic and host, tracer study, 20: 42850(R) (NYO-2043-130)
phosphorus metabolism in *Vicia faba*, effects of gibberellic acid on, tracer study, 20: 42771
radiation effects on formation of flower primordia in Xanthium, light and x, 20: 42842(R) (ANL-7136, pp 290-301)
radiation effects on tulip, genetic and morphological γ, 20: 42861(T) (NSJ-tr-53)
radiation effects on, effects of content of calcium, magnesium, and potassium in nutrient medium on γ, 20: 42915
radiation effects on chromosome aberrations in *Vicia faba*, x, 20: 42920
radiation effects on meiosis in *Vicia faba*, x, 20: 42921
radiation effects on chromosomes in *Crepis capillaris* sprouts, x, 20: 42936
radiation effects on diurnal variations in mitotic frequency in Pinus, gamma, 20: 42953
radiation effects on *Nitella flexilis*, biological, x, 20: 42998(R) (EUR-2992.f)
radiation monitoring at NRTS, 20: 45219
radiation monitoring of, at Savannah River Plant, January to June 1966, 20: 43577(R) (DPST-66-30-2)
radioactive contamination levels in aquatic and marine, 20: 43596
radioactivity content of, from fallout in West Germany, 20: 43626
radioinduced calcium release from, gamma, 20: 42916
radioinduced mutations of, use in breeding programs, 20: 42846 (IAEA-2466-13)
radioisotope contents in Arctic, 20: 43005
radiosensitivity of tropical, γ, 20: 42850(R) (NYO-2043-130)
radiosensitivity of, physiological parameters in, 20: 42849 (NP-16258)
radium-226 uptake by vegetables and cereals, relation to soil content, 20: 42792
separation of carbon-14-labeled organic acids from, by chromatography for liquid scintillation measurements, 20: 43125
strontium-90 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
strontium-90 content of, in East Germany from 1961 to 1963, 20: 43538
use of herbicides in weed control, tracer methods for, 20: 42742 (STI-PUB-113)

**PLASMA**
acceleration by electromagnetic fields, (E), 20: 44891
acceleration of cylindrical cluster of, resonance state for induction, (T), 20: 44895
acceleration of solar wind, producing geomagnetic storm, 20: 44471
acoustic and electromagnetic wave propagation in magneto-, coupled, (T), 20: 44899
acoustic-electromagnetic wave coupling across boundary of air and, (T), 20: 44908
atomic density measurements in afterglow, 20: 44852 (AD-629924)
book: *Magnetohydrodynamic Stability and Thermonuclear Containment*, 20: 44986
book: *Reviews of Plasma Physics*. Volume 2, 20: 44985(T)
boundary layer equations for, (T), 20: 44408
bremsstrahlung emission from theta-pinch, diagnostics determination from, 20: 44984
charged-particle waves in moving, properties of, (T), 20: 44958
containment in magnetic mirror machines, pulse-injected, 20: 44972
containment in magnetic traps, nonadiabatic analysis for, 20: 44977
containment of, book on, 20: 44985(T)
containment of, book on, 20: 44986
cyclotron echoes from highly ionized cesium, (E), 20: 44936
cyclotron instability of electron beams in, theory of two-stream, 20: 44894
density distribution measurements in, by multi-beam microwave probing, 20: 44857 (IAE-1153)
density in hollow-cathode arcs, 20: 44864 (ORNL-4010)
diagnostics by reflection of polarized waves, (T), 20: 44885
diagnostics of argon arc, stagnation point Langmuir probe, (E), 20: 44878
diagnostics of dense, using negative bias probes, (E), 20: 44909
diagnostics of, device for, 20: 44956
diagnostics using reaction kinetics, 20: 44928
diagnostics using resonant frequencies of coupled reactive structures, (E), 20: 44887
diagnostics with free-molecule Langmuir probe, (E), 20: 44876
diagnostics, design of probes with guard rings and thermocouples for, 20: 44862 (NASA-TM-X-1294)
diagnostics, Langmuir probe method for small-amplitude oscillations in, 20: 44918
diagnostics, microwave cavity, eigenfrequencies solution for, 20: 44907
dielectric function for degenerate electron, in magnetic fields, 20: 44904
diffusion across magnetic fields, (T), 20: 44963
diffusion across spatially periodic magnetic fields, 20: 44973
diffusion across spatially modulated magnetic fields, resonance in, 20: 44974
diffusion in toroidal traps, effect of magnetic field disturbances on, 20: 44875(T) (MATT-Trans-37)
dispersion relation of plasmon in electron gas, (T), 20: 44916
dynamics and interplanetary interactions of solar, 20: 44069 (IPPJ-44(J))
dynamics of z-pinch sheath, prior to cumulation, (E), 20: 44872(T) (LA-tr-66-58)
electric conductivity of partially ionized, 20: 44163(R) (AD-628528)
electric conductivity of, variable collision cross section effects on, (T), 20: 44877
electric fields in weakly turbulent, spatial and temporal correlation of,

(E), 20: 44924(T)
electric probe impedance in isotropic, measurement of, 20: 44927
electromagnetic and electroacoustic wave propagation in magneto-, coupled, (T), 20: 44899
electromagnetic characteristics of lossy, compressible, (T), 20: 44901
electromagnetic wave propagation in warm magneto-, ringing phenomena in, 20: 44944
electromagnetic wave propagation in stratified, (T), 20: 44951
electromagnetic wave interactions in magneto-, nonlinear, (T), 20: 44954
electromagnetic wave propagation in semiconductor, nonlinear theory of, 20: 44966
electromagnetic wave generation in, by nonlinear effects in strong magnetic field, (E), 20: 44893
electromagnetic wave reflection and transmission by transitional layers of, (T), 20: 44897
electron beam deceleration and thermalization in, (T), 20: 44882
electron collision frequency as function of charged particle seeding, 20: 44851 (AD-628777)
electron densities and collision frequencies from Apollo-type reentry sheath, (T), 20: 44861 (NASA-CR-596)
electron density and temperature of hydrogen, in spindle cusp, 20: 44860 (JUL-352-PP)
electron density in cylindrical, radial distribution of, (E), 20: 44896
electron density maximization in Penning gas, ionized by fission fragments, 20: 44933
electron energy dependence on pressure in duoplasmatron, 20: 44921
electron oscillation measurements in, errors in, 20: 44940
electron temperature in nitrogen afterglow, (E), 20: 44942
electron temperatures in helium, determination of, (T), 20: 44888
electronic recombination in argon and helium afterglow, 20: 44854 (AD-630074)
electrostatic wave damping in spatially nonuniform, 20: 44935
energy distribution functions of hot electron, design and performance of E × B analyzer for, 20: 44957
equations for warm, boundary conditions for unique solutions to linearized, 20: 44953
generation of very high-energy-density, 20: 44850(R) (AD-628506)
heating by magnetic pumping, collisional, (T), 20: 44949
hydromagnetic oscillations of uniform, in uniform and nonuniform magnetic field, (T), 20: 44950
hydromagnetic wave propagation in collisionless, effect of finite ion Larmor radius on, (T), 20: 44952
injection into closed magnetic container, 20: 44874(T) (MATT-Trans-36)
ion emission from electromagnetically trapped, energy of recharged, 20: 44976
ion energies in laser-produced, from foils, 20: 44932
ion resonance in weakly ionized, 20: 44889
ion spectral line splitting due to rotation in magnetic field, (T), 20: 44967
ion temperature of helium, Echelle monochromator for measuring, (E), 20: 44920
ion-acoustic waves in cesium and potassium, excitation of, (E/T), 20: 44960
ion-wave propagation in weakly-ionized gas-discharge, h-f, 20: 44930
ionization phenomena from Apollo-type reentry sheath, nonequilibrium, 20: 44861 (NASA-CR-596)
ionization properties of cesium, effects of high pressures and temperatures on, 20: 44979
light scattering by, (T), 20: 44938
magnetic field boundary from line currents in streaming, (T), 20: 44912
magnetic field diffusion into, cooled by solid walls, (T), 20: 44905
magnetohydrostatic equilibria in, axisymmetric, 20: 44858 (IPP-6/48)
microwave interactions with, diagnostics from, (E), 20: 44983
microwave reflection by, ray-theory interpretation of, 20: 44898
microwave refraction by nonhomogeneous cyclindrical, (T), 20: 44981
microwave refraction by, density determination from, (E), 20: 44982
motion of cylindrical sheets of, in geomagnetic field, (E/T), 20: 44415 (AD-628320)
oscillations in thermal cesium, low-frequency, (E), 20: 44906
oscillations in, Langmuir probe for determining, (T), 20: 44918
oscillations of low-pressure, drift-cyclotron, (T), 20: 44968
pair distribution functions for one-component, Monte Carlo calculation of, 20: 44910
particle collisions in, cluster scheme for, (T), 20: 44915
plasmoids interactions with acute-angled magnetic fields, properties of, 20: 44975
probe current in low-density, cylindrical, (T), 20: 44919
production by electron beams, paramagnetic amplification in, (E), 20: 44892
production by glow discharge of beams of, (E), 20: 44900
propagation constants of quasi-$TE_{11}$ modes in, (E), 20: 44903
properties of interstellar, magnetic field effects on, 20: 44881
properties of magnetic mirror confined, cusp injected, 20: 44971
radio wave emission at maximum frequency of hydrogen, continuous thermal, (T), 20: 44883
radio wave propagation in presence of weak gravitational field, (T), 20: 44096
reciprocity relations in compressible, 20: 44902
shock tube studies of, (T), 20: 44167
spectra from argon, Stark widths of, 20: 44931
spectra from pulsed-discharge, in vacuum, 20: 44959
spectra line broadening in, theory for Stark, 20: 44943
stability in hollow cathode discharge, 20: 44937
stability of magneto-, ion diffusion effects on, (T), 20: 44923(T)
stability of r-f excited, in constant magnetic field, (T), 20: 44929
stability of relativistic, garden hose, 20: 44880
stability of toroidal confined, (E/T), 20: 44945
stability of toroidal confined, observation of, (E), 20: 44946
stability of toroidal, effect of transverse currents on, 20: 44856 (IAE-1152)
stability of, book on, 20: 44986
stability of, from interactions of energetic electrons with partially ionized gases, (T), 20: 44939
stability of, hydromagnetic, 20: 44985(T)
stability of, with surface currents, 20: 44859 (IPP-6/53)
stability with oscillating-electron discharges, drift, (E), 20: 44863 (NP-16310)
stability with phase velocities below ion thermal velocity, drift, 20: 44934
stabilization of column, 20: 44964
stagnation pressure measurements with pitot tube, (E), 20: 44879
statistical mechanics of gravitational, 20: 44948
temperatures of atoms and ions in C stellarator discharges, (E), 20: 44911
thermal insulation of, in Tokamak, 20: 44873(T) (MATT-Trans-35)
thermodynamic properties of one-component, Monte Carlo study of, 20: 44910
thermodynamic properties of electron, (T), 20: 44955
turbulence spectrum in, weak, 20: 44969
wave amplification by charged-particle beam in nonlinear, longitudinal, (T), 20: 44965
wave interactions with electron beam in magnetic field, 20: 44853 (AD-630040)

**PLASMA JETS**
development of centrifugal, 20: 43179(R) (NYO-2082-6)
motion across magnetic fields, (T), 20: 44963
nozzle current of hypersonic argon, (E/T), 20: 44886
pressure measurements in, manometer for pulsed, 20: 44978
properties of electric arc, 20: 44925

**PLASTIC DEFORMATION**
effects on radioinduced color centers in potassium chlorides, (E), 20: 45041(T)

**PLASTICS**
analysis for elements using 2-Mev charged particles, 20: 43097
machining procedures for glass fibre reinforced, 20: 43864 (Y-1550)
radiation effects on carcinogenic effects of implanted, in rats, effects of exposure time on x, 20: 42840(R) (ANL-7136, pp 164-90)
uses in nuclear engineering, 20: 43471

**PLATES**
stress concentration around cylindrical holes in photoviscoelastic, 20: 43495(R) (AD-628806)

**PLATINUM**
coating with actinides, target preparation by, 20: 43396
corrosion in oxidizing atmospheres at high temperatures, 20: 43842
determination by charged-particle reactions at 2 Mev, 20: 43097
effects on exchange of deuterium between aniline and deuterium oxide, 20: 43275
effects on hydrogenation of deuterated and normal substituted ethylenes, mechanism of catalytic, 20: 43279
electron reactions at 18 Mev, anomalous secondary electron emission from, 20: 44117
photoelectric and optical properties of films of, in extreme ultraviolet, (E), 20: 44995 (ORNL-TM-1392)
properties for coating metals, 20: 43880
separation from other elements by ion exchange using triisoöctylamine, 20: 43439

**PLATINUM ALLOYS**
Pt–U, combustion kinetics of, 20: 43612

**PLATINUM ISOTOPES**
separation of, chemical purification following electromagnetic, 20: 4380

**PLATINUM ISOTOPES Pt-186**
nuclear data sheets, 20: 44713

**PLATINUM ISOTOPES Pt-187**
nuclear data sheets, 20: 44714

**PLATINUM ISOTOPES Pt-188**
nuclear data sheets, 20: 44715

**PLATINUM ISOTOPES Pt-189**
nuclear data sheets, 20: 44716
**PLATINUM ISOTOPES Pt-192**
energy levels from decay of iridium-192, (E), 20: 44700
**PLATINUM ISOTOPES Pt-195**
neutron capture by, platinum-196 energy-level transitions from, (E), 20: 44807
**PLATINUM ISOTOPES Pt-196**
energy-level transitions from neutron capture by platinum-195 ,(E), 20: 44807
**PLOWSHARE PROJECT**
air-blast waves in Dugout event, 20: 43461 (PNE-607F)
mineralogical investigations in debris of Gnome event, 20: 43464
near-surface spalling in Salmon experiment, 20: 43462 (UCRL-13225)
uses of contained underground nuclear detonations, 20: 43463 (UCRL-14756)
**PLUTONIUM**
activity coefficients in liquid calcium, cerium, lanthanum, silver, and uranium, 20: 43819
bibliography on, 20: 45236 (BNWL-113-17)
bibliography on, 20: 45237 (BNWL-113-18)
chemistry of, review on, 20: 43076 (NAS-NS-3058)
determination of, review of procedures for, 20: 43076 (NAS-NS-3058)
diffusion in Dowex-1 anion exchange resin, 20: 43418 (LA-3534)
diffusion in epsilon phase, self-, 20: 43932
dissolution for analysis, review on, 20: 43076 (NAS-NS-3058)
distribution in bone and reticulorendothelial tissues of mice, 20: 42997(R) (ANL-7136, pp 191-204)
effects in mice and rats, carcinogenic, 20: 42997(R) (ANL-7136, pp 191-204)
exchange between liquid magnesium–zinc alloys and fused chlorides, thermodynamics of, 20: 43819
excretion in mice and rats of, effects of DTPA on, 20: 42997(R) (ANL-7136, pp 191-204)
handling and storage of, safety aspects of, 20: 43578 (HW-59541)
metabolism in mice and rats of, 20: 42997(R) (ANL-7136, pp 191-204)
oxidation of, method for scrap and skulls using steam, 20: 43854 (HW-66431)
particle size determination at Rocky Flats, Colorado, 20: 43595
phase transformation in, effects of pressure on alpha ⇄ beta, 20: 43953
preparation of single crystals of alpha, equipment and techniques for, 20: 43904(R) (NUMEC-3428-23)
procurement and processing for German fast breeder prototype reactors, economics of, 20: 45151
production and properties of, as nuclear fuel, 20: 45099
production as reactor fuel in Britain, 20: 43875
production in France, 20: 45239(R) (NP-16267)
properties and purity of, for AEC purchase, program for determining, 20: 43070(R) (IDO-14679, pp 60-9)
properties of liquid, density and viscosity, 20: 43889 (CONF-660606-39)
recovery from low-enrichment fuels, 20: 45106(R) (ANL-7249)
separation from actinides and fission products by isotope dilution for mass spectroscopy, 20: 43067(R) (IDO-14679, pp 6-46)
separation from americium-241 by solvent extraction, 20: 43072(R) (IDO-14679, pp 193-229)
separation from irradiated uranium dioxide and uranium hydride using phtahlocyanine, 20: 43153
separation of rare earths from irradiated, 20: 43067(R) (IDO-14679, pp 6-46)
**PLUTONIUM ALLOYS**
Al–Pu, handling and storage of, safety aspects of, 20: 43578 (HW-59541)
Ce–Co–Pu, corrosive effects of liquid on carburized and uncarburized niobium and tantalum alloys, 20: 43829(R) (LA-3582)
Ce–Co–Pu, density and viscosity of liquid, 20: 43889 (CONF-660606-39)
Ce–Co–Pu, development and testing as liquid fuel, 20: 43814 (LA-DC-7581)
Fe–Pu, density and viscosity of liquid, 20: 43889 (CONF-660606-39)
fissium–Pu–U, burnup testing of, 20: 45106(R) (ANL-7249)
Ga–Pu, density and viscosity of liquid, 20: 43889 (CONF-660606-39)
Ga–Pu, stability of delta-phase plutonium-base, 20: 43895 (LA-DC-7934)
Mg–Pu, thermodynamics of dilute-plutonium liquid, 20: 43819
Pu–Th–U, burnup testing of, 20: 45106(R) (ANL-7249)
Pu–Ti–U, burnup testing of, 20: 45106(R) (ANL-7249)
Pu–U, processing of irradiated, economic aspects of, 20: 43435
Pu–U–Zr, burnup testing of, 20: 45106(R) (ANL-7249)
**PLUTONIUM COMPLEXES**
with hydrogen peroxide, formation of, in reduction of tetravalent plutonium to trivalent in perchloric acid, 20: 43245
with sulfates, stability constants for, 20: 43244
**PLUTONIUM COMPOUNDS**
work functions of, equipment for, 20: 43811(R) (BNWL-269, pp 1.1-28)
**PLUTONIUM FLUORIDES**
particle size on membrane filter paper, 20: 43595
**PLUTONIUM(IV) FLUORIDES**
fluorine-19 nuclear magnetic resonance spectra in paramagnetic, 20: 43208
**PLUTONIUM IONS**
radiation effects on pure tetravalent, role of air and argon in gamma, 20: 43358
radiolysis of solutions of trivalent, in $0.8N$ sulfuric acid, products from gamma, 20: 43358
reduction of tetravalent to trivalent, using hydrogen peroxide in perchloric acid solutions, 20: 43245
**PLUTONIUM ISOTOPES**
diffusion in Dowex-1 anion exchange resin, 20: 43418 (LA-3534)
**PLUTONIUM ISOTOPES Pu-238**
alpha decay of, barrier penetrabilities for, (T), 20: 44763
deposition on metals, autoradiographic control of, 20: 43866
effects on determination of americium-241 using coincidence methods, 20: 43158
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)
use as isotopic heat source, criticality considerations in, 20: 44628 (CONF-660303, pp 964-70)
**PLUTONIUM ISOTOPES Pu-239**
deposition on metals, autoradiographic control of, 20: 43866
distribution from nuclear explosion in salt deposit, 20: 43802
effects and distribution of injected, in rats, 20: 42840(R) (ANL-7136, pp 164-90)
effects on determination of neptunium-237 using coincidence methods, 20: 43158
gamma spectra, 20: 44634(R) (IDO-17188)
neutron absorption cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron fission at 0 to 25 kev and 170 to 770°K, Doppler effect on, (E/T), 20: 44627 (CONF-660303, pp 933-8)
neutron fission cross sections at 1 kev to 10 Mev, evaluation of published data on, 20: 44622 (CONF-660303, pp 796-808)
neutron fission cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron multiplication factor, (E), 20: 44626 (CONF-660303, pp 919-32)
**PLUTONIUM ISOTOPES Pu-240**
fission neutron source strength, calibration of Harwell, 20: 44594
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)
neutron fission cross sections at 1 kev to 10 Mev, evaluation of published data on, 20: 44622 (CONF-660303, pp 796-808)
**PLUTONIUM ISOTOPES Pu-241**
neutron absorption cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron capture and fission cross sections, (E/T), 20: 44623 (CONF-660303, pp 840-72)
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)
neutron fission cross sections at 20 to 200 ev, (E), 20: 44625 (CONF-660303, pp 910-18)
neutron fission cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron fission cross section from 0.01 to 0.5 ev, (E), 20: 44635 (IN-1012)
neutron multiplication factor, (E), 20: 44626 (CONF-660303, pp 919-32)
**PLUTONIUM ISOTOPES Pu-242**
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)
**PLUTONIUM NITRATES**
properties and purity of, for AEC purchase, program for determining, 20: 43070(R) (IDO-14679, pp 60-9)
**PLUTONIUM NITRIDES**
PuN–UN, radiation effects on, 20: 43988(R) (BNWL-269, pp 2.1-11)
**PLUTONIUM OXIDES**
handling and storage of, safety aspects of, 20: 43578 (HW-59541)
hazards from, in manufacture of reactor fuels, 20: 43630
particle size on membrane filter paper, 20: 43595
synthesis of substoichiometric, in mixtures with uranium oxides, 20: 43811(R) (BNWL-269, pp 1.1-28)
**PLUTONIUM(IV) OXIDES**
fabrication cost calculations for pelletization and compaction into fuel elements, 20: 43849 (BNWL-273(Vol.1 and App.)
fabrication of fuels of, cost analysis of, 20: 45095 (BNWL-273(Vol.3))
production of spheres of, methods for, 20: 43848(R) (BNWL-269, pp 5.1-36)
properties and purity of, for AEC purchase, program for determining, 20: 43070(R) (IDO-14679, pp 60-9)
strength of particulate, crust, 20: 43811(R) (BNWL-269, pp 1.1-28)
thermal stability of, 20: 45106(R) (ANL-7249)
BeO–$PuO_2$–$ThO_2$, nuclear parameters of fuel pellets of, 20: 45176
$PuO_2$–$UO_2$, radiation effects compacted rods of, 20: 43812(R) (BNWL-269, pp 4.1-9)
$PuO_2$–$UO_2$, radiation effects on Zircaloy-clad at high exposures, 20: 43988(R) (BNWL-269, pp 2.1-11)

- $PuO_2$–$UO_2$, radiation effects on clad fuel elements of, at high exposures, 20: 43989(R) (BNWL-269, pp 3.1-30)
- $PuO_2$–$UO_2$, sintering of pellets of, development of chamotte process for, 20: 43865(T) (EURFNR-96F)
- $UO_2$–$PuO_2$, fabrication of, flowsheets for, 20: 43869

PLUTONIUM RECYCLE TEST REACTOR
- fuel elements for, quality control of, 20: 43989(R) (BNWL-269, pp 3.1-30)

PLUTONIUM SULFATES
- stability constants for, 20: 43244

PNEUMATIC SYSTEMS
- design and performance of, for continuous measurement of purity of uranium(VI) fluoride in vapor streams, 20: 43101

POLAND
- strontium-90 accumulation in bones from contaminated diet, 20: 43619

POLARISCOPES
- design and performance of gamma, 20: 43683

POLAROGRAPHY
- instrumentation symmetry defects influence on, 20: 43698
- instrumentation symmetry defects influence on, 20: 43699

POLIOMYELITIS
- reactivation of x-ray inactivated virus at low temperature, 20: 42966

POLLEN
- dispersion of ragweed, measurement of, 20: 45235 (BNL-957)
- radiation effects on fat and starch content of cotton, gamma, 20: 42896
- radiation effects on formation of *Vicia faba*, x, 20: 42921

POLONIUM
- effects on determination of radium-228 by ion exchange and actinium-228 counting, 20: 43442
- separation of, from thorium in sulfuric acid solutions by ion exchange, 20: 43147

POLONIUM ISOTOPES Po-208
- spectra and energy levels of, 20: 44128

POLONIUM ISOTOPES Po-209
- hyperfine structure and nuclear magnetic moment of, 20: 44128

POLONIUM ISOTOPES Po-210
- beta decay of, bismuth-210 energy levels from, (E), 20: 44831
- contamination of pig skin by, effect of acidity of soiling solution on, 20: 43010
- content in plants and animals of arctic region, 20: 43005
- content in tissues of cigarette smokers, 20: 42952
- content in tobacco in, 20: 43581(R) (NP-16245)
- determination in air-filter samples, radiochemical, 20: 43512(R) (ANL-7136, pp 315-27)
- distribution from nuclear explosion in salt deposit, 20: 43802
- particle emission by, long-range, (E), 20: 44686

POLONIUM ISOTOPES Po-216
- beta emission from electrostatically collected decay products of, 20: 43387
- diffusion from soil surfaces, 20: 43543

POLONIUM ISOTOPES Po-218
- measurement in uranium mine air filters, 20: 43594(T) (AEC-tr-6763)

POLYCYTHEMIA
- erythropoiesis in patients with, iron-59 tracer study of, 20: 43015(R) (UCRL-16246, pp 1-18)
- radiotherapy using phosphorus-32, late leukemia development after, 20: 43014(R) (RLO-581-10, pp 33-6)
- therapy using triethylene melamine, 20: 43014(R) (RLO-581-10, pp 33-6)

POLYMERIZATION
- radiation and chemical methods of, for synthetic polymers on cellulose, review of, 20: 43346
- radioinduced cationic, review on, 20: 43292 (ORO-2968-21)
- radioinduced, relation between velocity of in-source and post-, 20: 43323

POLYMERS
- effects on dehydration of radioactive slimes, 20: 45218(T) (KFK-tr-201)
- preparation and properties of radiation-resistant, 20: 43286
- radiation chemistry of, using 2-Mev Van de Graaff accelerator for, 20: 43328
- radiation effects on dielectric, 20: 43991 (EGG-1183-2096)
- radiation effects on, nature of reactive species produced in, 20: 43370
- sorption and retention of iodine vapors on, 20: 45045(R) (BMI-X-10173)
- superconductivity in, evaluation of Little model for, 20: 44541

POLYPHENYL SYSTEMS
- thermal conductivity of, device for measuring, 20: 43270 (AEET-245)

POPULATIONS
- analysis for inbreeding coefficients and relations, computer program for, 20: 42836(R) (ANL-7136, pp 109-23)
- epidemiological study of Colorado, 20: 42700(R) (ANL-7136, pp 162-3)
- genetic analysis of mouse, for effects of sex-linked mutations, 20: 42837(R) (ANL-7136, pp 124-40)
- hazards to, during biological, chemical, and radiological warfare, 20: 43566 (AD-625251)
- hazards to, from operation of nuclear power plants, 20: 43632
- intake of cesium-137, iodine-131, and strontium-90 from foods by, methods for estimating, 20: 43573 (CONF-765-13)
- mortality data for, Monte Carlo analysis of, 20: 42698(R) (ANL-7136, pp 80-94)
- occupational status in 1945 of Japanese, surviving atomic disasters, 20: 42697 (ABCC-18-65)
- psychotic syndromes in Hiroshima, effects of exposure to atomic explosion on development of, 20: 42924
- radiation burden from fallout, in West Germany, 20: 43626
- radiation effects on health of Hiroshima and Nagasaki, 20: 42827(R) (ABCC-58-59)
- radiation effects on health of Hiroshima and Nagasaki, 20: 42828(R) (ABCC-59-60)
- radiation effects on competitive ability and fitness of Drosophila, x, 20: 42922
- radioinduced mutations in wheat, analysis of, 20: 42846 (IAEA-2466-13)
- radiosterilization of bark beetles for controlling, y, 20: 42883

POSITRON BEAMS
- interactions of relativistic, transverse resistive-wall stability for, (T), 20: 44058

POSITRONS
- annihilation in helium, 20: 44246
- annihilation in metals, ladder correction to static dielectric constant for, 20: 44247
- diffraction channelling in crystals, 20: 44134
- emission from copper-64 embedded in copper single crystals, 20: 45019
- interactions with electrons, double bremsstrahlung production by, (T), 20: 44202
- scattering by atoms at low energies, calculations for, 20: 44108(R) (AD-630172)

POTASSIUM
- analysis of, for metallic and oxygen impurities by emission spectrography, 20: 43083 (R-66SD3012)
- content in chicken eggs and meat, 20: 42735
- content in concrete raw materials, 20: 43514 (UCRL-16878)
- content in milk, regional and seasonal variations in, 20: 43597
- content in soils, gamma spectrometric measurements of, 20: 43542
- content in urine of man, 20: 42794
- determination by charged-particle reactions at 2 Mev, 20: 43097
- determination in plant materials, activation, 20: 43060 (CEA-R-2967)
- determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
- determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
- determination in thorium dioxide, spectrographic, 20: 43105
- determination of, in advanced cancer tissues, by activation analysis, 20: 43138
- effects on calcium-to-strontium-90 ratios in barley and oat culture media and tissues, 20: 42766
- effects on radiosensitivity of plants, 20: 42915
- heat transfer by boiling, in circular tubes, 20: 43485
- ion-acoustic waves in plasma of, excitation of, (E/T), 20: 44960
- metabolism in mammals, interspecies comparisons, 20: 42768
- purification and handling of, for use in corrosion loop, 20: 43083 (R-66SD3012)
- reactions of gaseous, with rare earth chlorides, thermodynamics of, 20: 43222
- separation from lithium chloride solutions, precipitation method for, 20: 43092 (Y-1553)
- slip ratio in liquid-vapor, at 1850°F, 20: 43482 (ORNL-TM-1519)
- specific volume at 1099 to 2287°F, (E), 20: 43946
- thermodynamic properties at boiling point to 2550°F, (E), 20: 43944
- thermodynamics of liquid, niobium loop for, 20: 43879
- vapor pressures at 2400°F, saturation, (E), 20: 43945

POTASSIUM ACID PHOSPHATES
- oxygen isotopic composition of, mass spectrometric method for, 20: 43146

POTASSIUM BROMATES
- analytical use in qualitative analysis of tetravalent and trivalent cerium mixtures, 20: 43122
- radiation effects on, kinetics of isothermal annealing of gamma, 20: 43362

POTASSIUM CHLORIDES
- proton channeling in, 20: 45016
- radiation effects on crystal structure of, neutron, 20: 43303
- radiation effects on dislocation densities in crystals of, neutron, 20: 43305
- radiation effects on color centers, crystal structure, and optical properties of crystals of, neutron and x, 20: 43306
- radiation effects on hardness of crystals of, gamma, neutron, and x, 20: 43304
- radioinduced color centers in, effects of deformation and strontium

impurity on, (E), 20: 45041(T)
radioinduced F centers in pure and calcium-doped, gamma, 20: 44996
$KCl-LiCl-UO_2Cl_2$, electrolysis of molten, at 500 to 600°C, 20: 43266(P)
$KCl-MgCl_2-NaCl-UO_2Cl_2$, electrolysis of molten, at 500 to 600°C, 20: 43266(P)
$MgCl_2-KCl-NaCl$, exchange of plutonium in liquid systems with magnesium–zinc alloys, thermodynamics of, 20: 43819

**POTASSIUM CHROMATES**
use in preparation of high-specific-activity chromium-51, 20: 43401

**POTASSIUM CYANIDES**
effects on sodium ion efflux from rat liver slices, 20: 42758
effects on uptake of zinc-65 by Ehrlich ascites cells *in vitro*, 20: 42775

**POTASSIUM FLUORIDES**
$CeF_3-KF$, density and molar volume of, 20: 43165 (BM-RI-6836)
$KF-NaF$, density and molar volume of, 20: 43165 (BM-RI-6836)
$KF-ThF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
$KF-UF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
$KF-YF_3$, density and molar volume of, 20: 43165 (BM-RI-6836)
$LaF_3-KF$, density and molar volume of, 20: 43165 (BM-RI-6836)
$LiF-KF$, density and molar volume of, 20: 43165 (BM-RI-6836)

**POTASSIUM IODATES**
effects on preparation of iodine-131-labeled hippuran, 20: 43403

**POTASSIUM IODIDES**
sorption by glass, tracer studies of kinetics of, 20: 43251

**POTASSIUM IONS**
effects of displacing, on enzyme activity and nucleotide metabolism in rat bone marrow, 20: 42788
effects on reduction of pyridine nucleotides in rat liver slices, 20: 42759
effects on sodium ion efflux from rat liver slices, 20: 42759
efflux from rat liver slices, relation to pyridine nucleotides, 20: 42758
reactions of monovalent, with dinonylnaphthalenesulfonic acid, effects of diluent on, 20: 43447

**POTASSIUM ISOTOPES**
use in geological dating, method and equipment for, 20: 43500(R) (COO-689-60)
use in geological dating, method for, 20: 43501(R) (COO-689-60, App.A-1)
use in geological dating, method for, 20: 43502(R) (COO-689-60, App.A-2)
use in geological dating, method for, 20: 43503(R) (COO-689-60, App. A-3)
use in geological dating, method for, 20: 43504(R) (COO-689-60, App.A-4)
use in geological dating, method for, 20: 43506(R) (COO-689-60, App. A-6)

**POTASSIUM ISOTOPES K-37**
energy levels, (E), 20: 44838

**POTASSIUM ISOTOPES K-39**
proton reactions (p,He-3) and (p,t) with, argon-37 and potassium-37 energy levels with $T = \frac{3}{2}$, (E), 20: 44659 (UCRL-16990)

**POTASSIUM ISOTOPES K-40**
calibration of counter for detection in man of, using intravenously injected potassium-42, 20: 42739(R) (COO-1339-3)
content in tissues of man and sheep, 20: 42940
distribution in water and silt of British estuaries, 20: 45224
measurement in sheep and swine for use as growth index, 20: 42739(R) (COO-1339-3)
use in analysis of potassium contents in milk, 20: 43597

**POTASSIUM ISOTOPES K-42**
determination in neutron-irradiated clays and soils, 20: 43607
gamma spectra, 20: 44634(R) (IDO-17188)
use for calibrating potassium-40 gamma detection efficiency of whole-body counter, 20: 42739(R) (COO-1339-3)

**POTASSIUM NITRATES**
radiolysis of, effects of lead, strontium, sulfate, and thallium ions on yields from gamma, 20: 43329

**POTASSIUM OXALATES**
fluorescence of trivalent lanthanide ions in, 20: 43212

**POTASSIUM OXIDES**
determination of, by scintillation counting of gamma radiation from potassium-40 decay, 20: 43121
effects on ion-exchange properties of aluminum silicates, 20: 43449

**POTASSIUM TUNGSTOCERATES**
preparation and physicochemical properties, 20: 43253

**POTASSIUM URANIUM OXYSULFIDES**
magnetic susceptibility, 20: 43207

**POTASSIUM URANIUM SULFIDES**
magnetic susceptibility, 20: 43207

**POTASSIUM URANYL CARBONATES**
energy levels of uranyl ions in, vibrational structure of ground and excited, 20: 43240

**POTATOES**
radiation processing of, effects on storage life of gamma, 20: 43773
radioinduced inhibition of sprouting of, 20: 43781
radioinduced sprout inhibition of, 20: 43783

**POWDER COMPACTS**
diffusion in high-melting metal, by low-melting liquid metals, 20: 43822

**POWDER METALLURGY**
conference on, New York, June 14–17, 1965, 20: 43822
fabrication methods for fiber-reinforced metal-matrix composites, 20: 43848(R) (BNWL-269, pp 5.1-36)
methods for fabrication of resonance integral measurement samples, 20: 45046(R) (IDO-17192)
molybdenum, pressing and sintering properties of powders of, 20: 43867

**POWDERS**
neutron diffraction analysis of, frequency dependence of intensity in, 20: 45013
neutron diffractometry of, equipment for high-pressure, 20: 43473(T)
use of compressed, for reactor pressure tube insulation, 20: 45056

**POWER BREEDER REACTORS**
containment for fast, optimization of secondary, 20: 45117 (ORNL-TM-1194)
core design for fast, 20: 45117 (ORNL-TM-1194)
design and economics of BN-350, 20: 45159
design of 1000 Mw(e) molten-salt, 20: 45116 (ORNL-3996)
development and economics of epithermal molten salt thorium, 20: 45155
development and economics of, 20: 45166
development in France, 20: 45157
development of fast, with steam cooling, 20: 45150
development of fast, in United Kingdom, 20: 45172
development of high-temperature thorium, with coated-particle fuel, 20: 45154
development of 1000-Mw(e) fast, 20: 45156
development of 250-Mw(e) prototype fast, 20: 45158
development of 300-Mw sodium prototype, 20: 45149
development of, Karlsruhe project on, 20: 45148
fuel burnup and economics of heavy water-moderated thorium, 20: 45153
fuel development for liquid metal fast, 20: 45106(R) (ANL-7249)
fuel element cycle and breeding process for fast, 20: 45147
fuel pins for fast, performance of, 20: 45117 (ORNL-TM-1194)
fuel procurement and processing for German prototype fast, economics of plutonium, 20: 45151
neutron cross sections for calculations on, accuracy of, 20: 45092
plutonium production in, 20: 43875

**POWER CYCLES**
performance of Rankine, Brayton, and Stirling, for RISE, 20: 43799 (NP-16281)
turbocompressor for Brayton, design and test of gas-bearing, 20: 43481(R) (NYO-3237-6)
working fluid for organic Rankine, 20: 43497(R) (SAN-651-1)

**POWER PLANTS**
fuel transportation costs in Canada for, fossil-, 20: 45177

**POWER REACTORS**
description of U. S. facilities, 20: 45052 (TID-8200(14th Rev.))
design, 20: 45170
development and economics of, 20: 45166
development of dual-purpose, in Israel, 20: 45188
development of high-temperature, AVR support for, 20: 45130
economics and status of dual-purpose, 20: 45189
economics of, model analysis of future, 20: 45128
fuels for, methods for increasing efficiency of, 20: 45184
fuels for, supply in 1970–1985 period, 20: 45118 (RISO-M-434)
moderator vessel for Swiss, design of, 20: 45169
neutron cross-section requirements for, future, 20: 45107 (CONF-660303, pp 1025-34)
neutron kinetics of PPR, calculation of, 20: 45104 (AEET-239)
operation of, public health evaluation of hazards from, 20: 43632
physics of thorium loaded beryllia moderated, 20: 45176
pressure vessel for 1000 Mw(e), design of prestressed concrete, 20: 45109(R) (EURAEC-1673)
pressure vessel surveillance, 20: 43997(R) (NRL-Memo-1663)
transuranium isotope production in, 20: 43800 (BNWL-140(Rev.1))

**POWER SUPPLIES**
design for DON Reactor fuel handling machine, 20: 45163
design for electron-optical converters, 20: 43656
development of ultrafast, for plasma generator, 20: 44850(P) (AD-628506)

**PRASEODYMIUM**
determination in magnesium alloys, quantometric, 20: 43112
separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)

**PRASEODYMIUM ALLOYS**
Al–Pr, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Pr, crystal structure of intermetallic compound, 20: 43920

**PRASEODYMIUM CHLORIDES**
properties of, magnetic and thermal, 20: 43176 (NP-16302)
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

**PRASEODYMIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
**PRASEODYMIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218
**PRASEODYMIUM HYDROXIDES**
structure of sols of, electron diffraction and microscopy studies on, 20: 43181 (ORNL-P-2439)
**PRASEODYMIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
fluorescence of trivalent, in sodium tungstate solution, 20: 43211
fluorescence of trivalent, in potassium oxalate solution, 20: 43212
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
**PRASEODYMIUM ISOTOPES Pr-138**
decay of isomeric, (E), 20: 44643 (JINR-P-2819)
**PRASEODYMIUM ISOTOPES Pr-141**
proton reactions (p,n) at 8 to 14 Mev, neutron spectra from, (E), 20: 44739
**PRASEODYMIUM ISOTOPES Pr-144**
gamma spectra, 20: 44634(R) (IDO-17188)
**PRASEODYMIUM OXIDES**
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
**PRASEODYMIUM PERRHENATES**
preparation and properties of, 20: 43217
**PRASEODYMIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219
**PRASEODYMIUM SYSTEMS**
O–Pr, phase studies of, at 0 to 1 atm and 200 to 1150°C, 20: 43967
**PRECIPITATION, ATMOSPHERIC**
cesium-137 content in Chicago, Ill., 1965, 20: 43512(R) (ANL-7136, pp 315-27)
**PREGNANCY**
effects on calcium-47 metabolism in goats, 20: 42739(R) (COO-1339-3)
**PRESSURE**
effects of hydrostatic support, on ultimate compressive strength of sintered materials, 20: 43909 (SC-DC-66-1888)
measurement in operating fuel rods, instrumentation for, 20: 43989(R) (BNWL-269, pp 3.1-30)
profiles in bearing films, 20: 43469 (TID-23350)
theory of, at nozzles in spherical pressure vessels, 20: 43467 (TID-23343)
**PRESSURE GAGES**
catalog of Russian radiometric, 20: 43639(T) (AEC-tr-6633)
**PRESSURE VESSELS**
description of AVR, 20: 45134
description of AVR reactor, 20: 45136
design for high-pressure neutron diffractometry, 20: 43473(T)
design of prestressed concrete, for 1000 Mw(e) BWR, 20: 45109(R) (EURAEC-1673)
design of prestressed-concrete, for reactor containment, 20: 45127(T) (ORNL-tr-1228)
fabrication of, for Beznau reactor, 20: 45167
inspection window design for, 20: 45062
materials for, impact and tensile property testing, 20: 45120 (SWRI-1228-7-35)
nozzles in, stress conditions of, 20: 43468 (TID-23344)
nozzles in, theory evaluation for internal and external pressures at, 20: 43467 (TID-23343)
radioinduced embrittlement of steels for, measurements using stress wave attenuation, 20: 43993(R) (EURAEC-1691)
stress analysis of spherical, 20: 43491 (ORNL-P-2472)
surveillance of power-reactor, 20: 43997(R) (NRL-Memo-1663)
welding of steel, gas-arc, 20: 43851(R) (EURAEC-1671)
**PRESSURIZED WATER REACTORS**
development and performance of, 20: 45181
**PRODUCTION REACTORS**
description of U. S. facilities, 20: 45052 (TID-8200(14th Rev.))
**PROMETHIUM**
separation from rare earths in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)
separation of, from cesium and zirconium by paper electrophoresis, 20: 43451
**PROMETHIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
**PROMETHIUM IONS**
electromigration of trivalent, in sodium hexametaphosphate during paper electrophoresis, 20: 43451
**PROMETHIUM ISOTOPES Pm-140**
gamma spectra, 20: 44634(R) (IDO-17188)
**PROMETHIUM ISOTOPES Pm-147**
contamination of pig skin by, effect of acidity of soiling solution on, 20: 43010
use in argon-ionization, helium-electron capture detector for gas chromatography, 20: 43156
use in radiosterilization device, 20: 43796(P)
**PROMETHIUM ISOTOPES Pm-149**
decay of, gamma-ray and conversion-electron spectra from, 20: 45046(R) (IDO-17192)
**PROMETHIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219
**PROPANE**
radiolysis of, effects of argon and xenon on gamma, 20: 43368
**PROPANE, 2-CHLORO-**
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**1,3-PROPANEDIONE, 1,3-DIPHENYL-**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
**2-PROPANETHIOL, 1-AMINO-**
effects on induction of phage particles in *E. coli* during space flight, 20: 42911
radioprotective properties, space flight studies, 20: 42912
**1-PROPANOL**
effects on gamma radiation effects on biphenyl, spectral studies on, 20: 43314
solvent properties for fructose, glucose, and sucrose, 20: 43402
2,2′-dimethyl-, spectra of, NMR studies of effects of deuterium on optical purity of, 20: 43254
**2-PROPANOL**
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
effects on gamma radiation effects on biphenyl, spectral studies on, 20: 43314
radiolysis of, effects of substituted benzenes on gamma, 20: 43318
solvent properties for neptunium, 20: 43396
spectra of, NMR studies of effects of deuterium on optical purity of, 20: 43254
2-propanol–nitrates, radiolysis of, yields of primary hydrogen during gamma, 20: 43351
**1-PROPANOL, 2-METHYL-**
solvent properties for fructose, glucose, and sucrose, 20: 43402
**PROPELLANTS**
separation of uranium-235 from hydrogen rocket, method for, (T), 20: 45201
**PROPENE**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43313
radiation effects on reactions with hydrobromic acid in liquid phase at −79°C, 20: 43298
**PROPENE, HEXACHLORO-**
properties for chlorination of uranium (IV) oxide, 20: 43443
**PROPENE, 2-METHYL-**
effects on gamma radiation effects on methanol glass, spectral studies on, 20: 43314
**PROPENE POLYMERS**
iodine loss in dissolvers of, method for determining, 20: 43069(R) (IDO-14679, pp 51-9)
**PROPENEDIOL**
effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313
**PROPERDIN**
radiation effects on, in human and bovine serum, uv, 20: 42823
**PROPIONIC ACID**
synthesis in bacteria, enzyme reactions for, 20: 42737(R) (ANL-7136, pp 231-42)
**PROPIOPHENONES**
radiation effects on, ESR studies on effects of solvents in gamma, 20: 43313
**PROPORTIONAL DETECTORS**
design of small-volume x-ray, 20: 43550(R) (NYO-844-67)
energy response of argon-methane, linearity of, 20: 43736
performance of boron trifluoride, for neutron spectroscopy, 20: 43692
performance of boron trifluoride, for determining neutron dose equivalent rates and spectra, 20: 43694
radiation effects on amplitude distribution of boron trifluoride, pulsed $\gamma$ and x, 20: 43756
use in neutron dosimetry, 20: 43671 (ORNL-P-2467)
**PROPULSION**
heat sources for hydrospace, performance of cobalt-60 as, 20: 43797 (AGN-8163(Vol.3))
radioisotope power source for submersible vehicles, 20: 43799 (NP-

16281)
space, biphenyl working fluid in Rankine cycle for, 20: 43497(R) (SAN-651-1)
**PROSTIGMINE**
radiation effects on reactivity of rat intestine to, 20: 42964
**PROTACTINIUM**
determination in ocean deposits, 20: 43550(R) (NYO-844-67)
separation from neptunium and thorium by solvent extraction, 20: 43383
separation from perchloric acid solutions by filtration, ion exchange, and solvent extraction, 20: 43431
separation of, from thorium in sulfuric acid solutions by ion exchange, 20: 43147
separation of, from other elements by sorption by activated charcoal, 20: 43148
**PROTACTINIUM IONS**
chemical properties of pentavalent, in perchloric acid solutions, 20: 43431
**PROTACTINIUM ISOTOPES Pa-231**
determination of, in neptunium-237 and irradiated thorium, radiochemical, 20: 43383
use in age estimations for Pleistocene events, 20: 43557
**PROTACTINIUM ISOTOPES Pa-233**
determination of, in neptunium-237 and irradiated thorium, radiochemical, 20: 43383
neutron total cross sections, (E), 20: 44604 (CONF-660303, pp 67-74)
preparation and properties of, as tracer, 20: 43383
**PROTECTIVE CLOTHING**
design for reactor maintenance personnel, 20: 43575 (CONF-660621-1)
evaluation of physiological stress of pressurized suits, 20: 43571 (AHSB(RP)-R-70)
**PROTECTIVE OINTMENTS**
therapeutic use of thorium X in, for skin diseases, 20: 43046
**PROTEINS**
amino acids uptake by, in chloroplast-containing fractions of bean leaves, 20: 42706(R) (NYO-2373-1)
biological properties, genetic control, and structure of Bence-Jones, 20: 42837(R) (ANL-7136, pp 124-40)
effect on succinic oxidase activity in ultraviolet-irradiated *Mycobacterium phlei*, 20: 42810
effects of dietary levels of, on liver changes in gamma-irradiated rats, 20: 42864
effects of heat on properties of globular, 20: 42841(R) (ANL-7136, pp 266-89)
effects of microwave exposure on blood serum, of man and rabbits, 20: 42876
effects of protein phytohemagglutinin on synthesis of, tracer study, 20: 43272(R) (RLO-581-10, pp 5-32)
effects of ribonuclease and deoxyribonuclease on metabolism of, in Ehrlich's ascitic carcinoma, 20: 42728
effects on erythropoietic index and iron content in patients receiving radiotherapy for uterine cancer, 20: 42908
glyco-, radiation effects on content in hyperthyroid rats, 20: 42805
ion binding properties of human serum, 20: 42743 (UCRL-14631)
labeling with iodine-131 of, using chloramine T, 20: 43274
radiation effects on frog serum, gamma, 20: 42787
radiation effects on heat and light-induced phosphorescence of, ultraviolet, 20: 42803
radiation effects on binding of, with malonaldehyde, 20: 42799(R) (UCB-34P95-1)
radiation effects on serum content of, uv, 20: 42823
radiation effects on, in mitochondria and chromophil bodies of central nervous system, gamma and x, 20: 42866
radiation effects on metabolism in dogs, partial-body x, 20: 42939
radiation effects on metabolism in rabbit ovaries, x, 20: 42941
radiation effects on serum fractions in rabbits injected with bone marrow and trace elements, x, 20: 42870
radiation effects on content of, in granule-free suspending medium of lysosomes, gamma, 20: 42975
radioinduced formation of sulfur compounds and aromatic hydrocarbons from, in meats, 20: 42973
synthesis in early frog embryos, tracer study, 20: 42839(R) (ANL-7136, pp 154-61)
synthesis of liver mitochondrial, enzyme reactions for, 20: 42737(R) (ANL-7136, pp 231-42)
zinc-65 distribution in serum fractions of guinea-pig, 20: 42791
**PROTON BEAMS**
effects of, on mice centrifuged prior to exposure, 20: 42985
**PROTON PAIRS**
annihilation of, effects of form factors on cross sections for $\mu^-\mu^+$, 20: 44188
**PROTON SOURCES**
design modification of U-120 cyclotron, for negative hydrogen ion production, 20: 44056
**PROTON SPECTROMETERS**
design and performance of scintillation, with alpha discrimination, 20: 43681
**PROTON TOTAL CROSS SECTIONS**
measurement for nuclei near $Z = 28$ at 17 Mev, (E), 20: 44662 (USC-136-111)
measurement of, method for, 20: 44687
**PROTONS**
biological effects of radiation with, 20: 43625
channeling in ionic solids, 20: 45016
effects of radiation dose on RBE of, 20: 42898
effects on cabbage seeds RBE of high energy, 20: 42898
effects on mice, protective effects of isologous bone marrow injections against, 20: 42981
effects on mice, protective effects of indolyl- and mercapto-alkylamines against, 20: 43002
flux in auroral zone, anticorrelations with electrons, (E), 20: 44442
flux in magnetosphere, Mariner 4 measurements of, 20: 44455
interactions in emulsions at 24 Bev/c, method of analysis of mechanism for inelastic, 20: 44192(T)
interactions of bound and free, with mesons $(\pi^-)$ at 2.8 Bev/c, ratio of, 20: 44177 (NP-16278)
interactions with mesons $(\pi^-)$ at 3.2 and 4.2 Bev/c, multi-pion final states from, (E), 20: 44178 (UCRL-16881)
interactions with neutrons at 15 to 30 Mev, recoil technique for differential cross section measurements on, 20: 44632 (CONF-660303, pp 1084-91)
interactions with electrons, radiative corrections for, 20: 44179
interactions with mesons $(\pi^-)$ at 10 Bev, second correction to phase integral for, (T), 20: 44182
interactions with mesons $(\pi^-)$ at 7 Bev, one-meson theory for charge distribution from inelastic, 20: 44183
interactions with mesons $(\pi^+)$ at high energies, one-Regge-pole exchange model for, 20: 44184
interactions with antiprotons, effects of form factors on cross sections for $\mu^-\mu^+$ annihilation, 20: 44188
interactions with protons at 2.26 Bev, differential cross section for inelastic, (E), 20: 44189
interactions with mesons $(K^+)$ at 2.26 Bev/c, cross sections for $Z^+$ baryon production in, (E), 20: 44195
interactions with protons, model for deuteron production in, 20: 44196
interactions with photons, Regge-pole model for $X^0$ (958) production in, (T), 20: 44204
interactions with mesons $(\pi^-)$, $\rho'$ trajectory contribution to charge-exchange, 20: 44222
interactions with antiprotons, quark model predictions for annihilation, (E/T), 20: 44224
interactions with mesons $(\pi^+)$ at 8 Bev/c, decay angular distributions of resonances from, (E), 20: 44226
interactions with antiprotons at 5 to 9 Bev/c, cross sections for charge-exchange, (E), 20: 44227
interactions with mesons $(\pi^-)$ at 1.7 Bev/c, $T \geq 1$ dipion (965) enhancement, (E), 20: 44229
interactions with deuterons at 135 Mev, parameters for elastic, (E), 20: 44233
interactions with mesons $(\pi^+)$ at 0.4 to 4 Bev/c, direct $\Delta_\delta$ resonance model for backward elastic, (T), 20: 44236
interactions with mesons $(K^-)$ and $(\pi)$ at high energies, branching ratio predictions for, (T), 20: 44237
interactions with photons, Reggeized vector meson exchange for meson $(\pi^0)$ production in, (T), 20: 44240
interactions with mesons $(\pi^-)$ at 11 Bev/c, structures in $4\pi$ mass system from, (E), 20: 44241
interactions with photons at 1.36 to 3.0 Bev, single meson $(\pi^0)$ production from, (E), 20: 44242
interactions with protons at 3.00 Bev, isospin 1 (966) resonance production from, (E), 20: 44243
interactions with mesons $(K^0)$ at low energies, S-wave scattering length determination from, (E), 20: 44244
interactions with mesons $(\pi^-)$ at 7 and 12 Bev/c, structure with $A_2$ (1286) and R (1675) from, (E), 20: 44245
interactions with mesons $(K^0_2)$ at 300 Mev/c, hyperon-meson $(K^0_1)$ production ratio of, (E), 20: 44250
interactions with electrons, cross sections for elastic, (E), 20: 44253
interactions with mesons $(K^+)$ at 3.0 to 5.0 Bev/c, strangeness +2 meson resonance at 1280 Mev production from, (E), 20: 44262
interactions with antiprotons at 1.0 to 2.50 Bev/c, cross sections for elastic, (E), 20: 44263
interactions with antiprotons, mesons $(\pi^-)$, and $(\pi^+)$, Regge trajectories for minima in differential cross sections for, 20: 44264
interactions with mesons $(K^+)$ at 4.6 Bev/c, $K^*$ (1320) production from, (E), 20: 44265
interactions with mesons $(\pi^-)$ and $(\pi^+)$ at 4 Bev/c, backward elastic,

(T), 20: 44267
interactions with mesons ($\pi^-$) and ($\pi^+$) at 30 Bev/c, differential cross section for elastic, (T), 20: 44267
interactions with photons, absorptive corrections for N* production in, (T), 20: 44278
interactions with antiprotons and mesons, models for inelastic two-body, 20: 44359
interactions with mesons ($\pi^+$) at 2.3 to 4.0 Bev, differential cross sections for, (E), 20: 44248
motion of geomagnetically trapped, effect of superimposed electric field on, (T), 20: 44434
photoproduction on helium-3 at 12 to 170 Mev, angular distributions and energies from, (E), 20: 44711(T)
polarization in dysprosium-doped magnesium lanthanum nitrate, 20: 45004
polarization in radiation damaged polyethylene by solid effect, 20: 45024
RBE for human body, 20: 42865
reactions ($p,\alpha$) with aluminum-27, testing T-invariance by, (E), 20: 44793
reactions ($p,\alpha$) with calcium-40, potassium-37 energy levels from, (E), 20: 44838
reactions ($p,\gamma$) with deuterium, calculations with elastic unitarity and and nonsymmetric three-body wave functions, (T), 20: 44748
reactions ($p,\gamma$) with silicon-28, phosphorus-29 energy levels from, (E), 20: 44790
reactions ($p,\gamma$) with sulfur-34, chlorine-35 energy-level quantum numbers and transitions from, (E), 20: 44808
reactions ($p,\gamma$) with phosphorus-31 at 0.8 to 1.16 Mev, sulfur-32 energy-level transitions from, (E), 20: 44822
reactions ($p,\gamma$) with beryllium-7 at 483 to 1932 kev, cross sections for, (E), 20: 44076
reactions (p,He-3) and (p,t) with potassium-39, argon-37 and potassium-37 energy levels with $T = 3/2$, (E), 20: 44659 (UCRL-16990)
reactions (p,He-3) with magnesium-26 at 50 Mev, sodium-24 isobaric analogue states from, (E), 20: 44758
reactions (p,n) with chlorine-37, yield curves for, (E), 20: 44612 (CONF-660303, pp 562-76)
reactions (p,n) with gold-197, indium-115, lanthanum-139, niobium-93, praseodymium-141, tantalum-181, and yttrium-89 at 8 to 14 Mev, neutron spectra from, (E), 20: 44739
reactions (p,n) with helium-3 at 13.1 Mev, cross sections for, (E), 20: 44786
reactions (p,n) with calcium-40, carbon-12, magnesium-24, silicon-28, and sulfur-32, threshold energies for, (E), 20: 44811
reactions (p,n) with gases, determinations of carbon-13, nitrogen-15, oxygen-17, and oxygen-18 using, 20: 43115
reactions (p,p), ($p,\gamma$), and ($p,p,\gamma$) with argon-36, potassium-37 energy levels from, (E), 20: 44838
reactions (p,t) with iron-57 at 40 Mev, L = 0 transitions in, (E), 20: 44756
reactions in spark chamber, ionization measurements from, 20: 43691
reactions in thick iron targets at 100 to 450 Mev, 20: 43550(R) (NYO-844-67)
reactions with aluminum at 5 to 12 Mev, stopping power in, (E), 20: 44034
reactions with complex nuclei at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
reactions with complex nuclei at 25 to 400 Mev, data from inelastic, (E), 20: 44720
reactions with emulsion nuclei at 24 Bev in strong pulsed magnetic field, quasi-nucleon interactions in, 20: 44280
reactions with hydrogen and inert gases, cross sections for double electron capture by 2- to 50-kev, (E), 20: 44140
reactions with lunar surface at 30 kev, luminescence, (T), 20: 44035
reactions with nuclei near Z = 28, total cross sections for, (E), 20: 44662 (USC-136-111)
reactions with nuclei from Z = 4 to 92 at 99 Mev, total cross sections for, (E), 20: 44687
reactions with nuclei, elemental surface analysis by, 20: 43097
scattering by lead-208 at 24.55 Mev, inelastic, (E), 20: 44772
scattering by lead-208 inelastic, (E), 20: 44787
scattering by lead-207, lead-208 isobaric analogue state in elastic and inelastic, (E/T), 20: 44798
scattering by lead-207 at 24.5 Mev, lead-207 and lead-208 energy levels from inelastic, (E), 20: 44801
scattering by magnesium-25 at 5 and 6 Mev, elastic and inelastic, (E), 20: 44737
scattering by magnesium-25 at 4.5 to 6.1 Mev, cross-section fluctuations in elastic and inelastic, (E), 20: 44738
scattering by nickel-58 and nickel-60, testing nuclear model by inelastic, (E/T), 20: 44658 (UCRL-16984)
scattering by nitrogen-14 at 7 to 11 Mev, inelastic, (E), 20: 44840
scattering by nuclei, interference effects in Coulomb and nuclear polarized, (T), 20: 44741
scattering by nuclei with A = 44 to 74, isobaric analogue states from, (E), 20: 44761
scattering by nuclei, analogue-state resonances in elastic and inelastic, (T), 20: 44796
scattering by titanium-46, inelastic, (E), 20: 44765
temperature and velocity of, in solar wind, (E), 20: 44078
trajectories in the geomagnetic field, 20: 44461

**PROTOZOA**
radiation effects on, lethal $\alpha$, $\beta$, $\gamma$, and x, 20: 42934

**PSEUDOUREA, 2-(2-AMINOETHYL)-2-THIO-**
effects on acceleration tolerance of mice and guinea pigs, 20: 43004
protective effects against $\gamma$ and protons in mice, 20: 43002
radioprotective effects on mice, evaluation during fractional and prolonged irradiation, 20: 42992
radiosensitivity effects in mice, 20: 42988

**PSYCHOLOGY**
use in industrial error reduction programs, 20: 45241 (SC-TM-65-135)

**PUERTO RICO**
radiation effects on ecology of tropical rain forest in, $\gamma$, 20: 42853(R) (ORO-3299-1)

**PULSE ANALYZERS**
converters for, design of pulse height compensator for time to amplitude, 20: 43651
design and performance of multichannel, 20: 43641
design and performance of, for simultaneously recording pulse density and time rate for gas chromatography of labeled material, 20: 43643
use of, in LET measurements and neutron dosimetry, 20: 43671 (ORNL-P-2467)

**PULSE GENERATORS (ELECTRONICS)**
design for electrochemical studies, 20: 43067(R) (IDO-14679, pp 6-46)
design of high-voltage nanosecond, 20: 43655
design of random amplitude modulated, 20: 43652
design of solid state nanosecond, using Marx bank techniques, 20: 43650

**PULSE MODIFIERS**
design of pulse multiplier for identifying charged particles, 20: 43670 (INR-693/I/PL)
development of Brady capacitive divider, 20: 43634 (SLAC-PUB-199)

**PUMPS**
design for organic Rankine cycle working fluid, 20: 43497(R) (SAN-651-1)

**PUPAE**
radiosensitivity effects of developmental stage in Ephestia, x, 20: 42970

**PUREX PROCESS**
plant for, remote equipment and methods for repairs in, 20: 43416 (ISO-SA-24)
separation of uranium-233 from thorium run in, by anion exchange and peroxide precipitation, 20: 43427 (RL-SEP-712)
separations plant using, remote maintenance in, 20: 43417 (ISO-SA-25)

**PURINES**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

**6-PURINETHIOL**
use with x-radiation to suppress immune response in human kidney transplantation, 20: 43032

**PYRAZINE**
complexes with uranyl chlorides, nitrogen donor capacity in, effects of methyl substitution on, 20: 43243

**PYRENE**
effects on radiation effects on polystyrene solutions, 20: 43355

**PYRIDINE**
deuterium exchange between, and ammonia, effects of ring position on, 20: 43216

**PYRIDINE COMPLEXES**
with rare earths, preparation and properties of, 20: 43231

**PYRIDINE, VINYL-**
radioinduced graft polymerization on fiber glass, silica gel, and zirconium oxide, preparation of ion exchange material by, 20: 43311

**PYRIDOPYRIMIDINE**
spectra of deuterated and normal, PMR, 20: 43282

**PYRIDOXINE**
metabolism in dogs fed irradiated meat, 20: 42793

**PYRIMIDINES**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

**PYROCATECHOL**
amine derivative, radiation effects on content in rat adrenals, 20: 42964

**PYROPHORICITY**
analysis of, x-ray diffractometric, 20: 43068(R) (IDO-14679, pp 47-50)

**PYROPHOSPHORIC ACID, 3-METHYL-2-BUTENYL ESTERS**
preparation of carbon-14-labeled, 20: 43407

**PYRUVATE CARBOXYLASE**
manganese ion determination in, 20: 42773

**PYRUVATES**
radiation effects on metabolism of, in bone marrow, 20: 42822

## Q

**QUALITY CONTROL**
  equipment for cylindrical pellet, 20: 43474(P)
  materials and methods for, of fissionable materials for AEC purchase, 20: 43070(R) (IDO-14679, pp 60-9)

**QUANTUM ELECTRODYNAMICS**
  electron Green function in, pole singularities in, 20: 44397
  gauge classes and S-matrix invariance in, 20: 44303
  model of interacting fields in, gauge-invariant, 20: 44340
  particle interactions at high energies in, double logarithmic asymptotics for two-body, 20: 44361
  propagators in, modification of charged-particle, 20: 44488
  theory for, historical development of, 20: 44494

**QUANTUM MECHANICS**
  angular functions for orbital momentum for three-body problem in, 20: 44500
  book: *The Quantum Equation and the Theory of Fields*, 20: 44401
  deuteron photodisintegration in Coulomb fields of heavy nuclei as three-body problem in, (T), 20: 44827
  Schroedinger equations for coupled-channel calculations on nuclear reactions, solution of, (T), 20: 44653 (PUC-937-219)
  solution of Schroedinger equation for nucleon-nucleus scattering using Green-function method, (T), 20: 44836
  symmetry groups in, $O_4$, dynamical, 20: 44290
  symmetry groups in, dynamical SU(3), 20: 44291
  wave equation solutions for potentials with Coulomb tails, peculiarities in Schroedinger, 20: 44283
  wave equations for three-body problem, partial-wave, (T), 20: 44499
  wave functions in, multiparticle hamiltonians in spectra of Schroedinger, 20: 44484

**QUARTZ**
  analysis for elements using 2-Mev charged particles, 20: 43097
  radiation effects on sorptive properties of, for hydrogen and nitrogen, 20: 43302

**QUINOLINES**
  deuterium exchange between, and ammonia, effects of ring position on, 20: 43216

**8-QUINOLINOL**
  solvent properties for europium and uranyl ions, 20: 43432
  8-quinolinol–thenoyltrifluoroacetone, solvent properties for europium and uranyl ions, 20: 43432

**QUINONES**
  oxygen-18 exchange between, and water in acidic media, mechanisms of, 20: 43276

## R

**RABBITS**
  cesium metabolism in, comparison with other mammals, 20: 42768
  immune reactions in, measurement of, 20: 42835(R) (ANL-7136, pp 63-80)
  immune reactions of adult, newborn, and cultured lymphoma cells from, to phytohemagglutinin, 20: 43272(R) (RLO-581-10, pp 5-32)
  microwave effects on blood serum proteins of, 20: 42876
  potassium metabolism in, comparison with other mammals, 20: 42768
  radiation effects on fatty acid peroxide-induced atherosclerosis in aorta of, 20: 42813
  radiation effects on fatty acid peroxide-production in the livers of, 20: 42813
  radiation effects on hemolysin synthesis in, x, 20: 42835(R) (ANL-7136, pp 63-80)
  radiation effects on immune reactions in, x, 20: 42855(R) (TID-23203)
  radiation effects on semicircular-canal function in, alpha, 20: 42858(R) (UCRL-16246, pp 74-83)
  radiation effects on immune reactions in, x, 20: 42830 (AD-635598)
  radiation effects on protein fractions of serum, x, 20: 42870
  radiation effects on acetylcholine metabolism in nerve tissue of, γ, 20: 42875
  radiation effects on heart muscles of, 20: 42877
  radiation effects on protein metabolism in ovaries of, x, 20: 42941
  radiation effects on lysozyme activity in serum of, x, 20: 42944
  radiation effects on ultramicroscopic structure of retina, x, 20: 42958
  radiation effects on intestinal absorption of carbon-14-labeled L-alanine in, γ, 20: 42972
  radiation effects on lysosomes isolated from polymorphonuclear leukocytes from, gamma, 20: 42975
  radiation effects on, protective effects of apilac and cystamine against x, 20: 43009
  radioinduced inhibition of oxidation phosphorylation in, by acetone fraction from liver lipids, 20: 42825
  radioiodination of tissue-soluble proteins in, using chloramine T, 20: 43274
  radioprotective effects of DNA, RNA, and orotic acid on leukopoiesis, 20: 42937
  radiosensitivity of, seasonal variations in γ, 20: 42848 (NP-16256)
  Thorotrast sorption in articular cartilage of, 20: 42772

**RADIATION**
  dose calculations in interstitial radium therapy, 20: 43616
  dose to skeletons of human fetuses and children from strontium isotopes, 20: 43605
  dosimetry of, correlated with radiation injuries in tissues, 20: 43572 (BNWL-SA-816)
  effects of atomic bomb explosion on health of populations of Hiroshima and Nagasaki, 20: 42827(R) (ABCC-58-59)
  effects of atomic bomb explosion on health of populations of Hiroshima and Nagasaki, 20: 42828(R) (ABCC-59-60)
  effects of ionizing, on yeasts sensitized with iodoacetamide, 20: 42901
  effects of length of exposure and ultrafractionation on living organisms, 20: 43625
  effects of, from space flight on phage production and viability of *Escherichia coli*, 20: 42912
  effects on beryllia–thoria–urania dispersions, in-reactor, 20: 44014
  effects on binding of heme proteins to malonaldehyde, 20: 42799(R) (UCB-34P95-1)
  effects on biological systems, standards for, 20: 43602
  effects on calcium release by oats and peaches, 20: 42815
  effects on cationic polymerization, review on, 20: 43292 (ORO-2968-21)
  effects on Drosophila X chromosomes, 20: 42709(R) (TID-23233)
  effects on engineering materials in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
  effects on ethylene–alkyl acrylate copolymers, 20: 43376
  effects on excretion of aminoisobutyric acid, deoxyuridine, and thymidine in rats, 20: 42807
  effects on fertility of male silkworms as affected by post-irradiation temperature, 20: 42930
  effects on flow and stability of rock salt, 20: 45217 (ORNL-P-2126)
  effects on frozen aqueous solutions of sodium nitrite, ESR spectral studies on, 20: 43309
  effects on geologic materials, 20: 43987 (BNL-10569)
  effects on graft polymerization of synthetic polymers on cellulose, 20: 43346
  effects on graft polymerization of styrene, vinylphosphonic acid dichloranhydride, and vinylpyridine on fiber glass, silica gel, and zirconium oxide, 20: 43311
  effects on guinea pig skin, protective effects of cysteamine against, 20: 42990
  effects on heart muscles of frogs and rabbits, 20: 42877
  effects on hematopoietic system function, 20: 42845 (CONF-660543-1)
  effects on immune reactions in guinea pigs, 20: 42878
  effects on innervation system of dog meninges, 20: 42881
  effects on intestinal reactivity to parasympathomimetic substances in rats, 20: 42964
  effects on malonaldehyde production in amino acids, effects of impurities on, 20: 42799(R) (UCB-34P95-1)
  effects on mice, protective effects of bone marrow treated with cortisone or nitrogen mustard against, 20: 42995
  effects on mitosis in erythroblasts of man, chronic low-level exposure, 20: 42884
  effects on monolithic microelectronic circuits, 20: 43753(R) (AD-636773)
  effects on oxidation of nitrogen, electron and ion recombinations in, 20: 43354
  effects on oxidative phosphorylation in rabbits, 20: 42825
  effects on polymerization of vinyl ethers, 20: 43379(P)
  effects on polymerization of ethylene, kinetics of low-dose, 20: 43327
  effects on polymerization of acetone–acrylonitrile and acrylonitrile at –95 to –196°C, 20: 43277
  effects on polystyrene solutions, effects of pyrene on, 20: 43355
  effects on rat blood serum bactericidal activity, 20: 43003
  effects on silicon carbide-coated graphite at 600°C, 20: 43825 (BNWL-242)
  effects on solutions of acrylonitrile–styrene polymers, 20: 43355
  effects on stoichiometry of urania, in-reactor, 20: 43811(R) (BNWL-269, pp 1.1-28)
  effects on transistors, anomalous photocurrent production in, 20: 43755 (SC-DC-66-1821)
  effects on type 304 stainless steel, methods of reducing, 20: 43999 (ORNL-TM-1544)
  effects on uranium, 20: 43995 (JAERI-4037)
  effects on virus inactivation, 20: 42954
  hazards of, to populations during nuclear wars, 20: 43566 (AD-625251)
  inhibiting effects of natural ionizing, on Paramecium cultures, 20: 42886
  research on, technical progress review of, summer 1966, 20: 43758
  role in evaluation of, 20: 42906
  use in industry, medicine, and agriculture, 20: 43764
  use in production of new materials, review of, 20: 43792

**RADIATION CHEMISTRY**
book: *Chemical Dosimetry of Ionizing Radiations*, 20: 43293(T) (AD-633448)
conference on nuclear and radiation chemistry, 20: 43356
of polymers, reactive species produced in, 20: 43370
peptide bond, radiolysis in polyamino acids, 20: 42826
polymer irradiation using 2-Mev Van de Graaff accelerator, experience in, 20: 43328
radioinduced chemical reactions in, computational procedure for analyzing kinetics of, 20: 43377
recoil reactions in gaseous phase above 10 ev, excitation function and yields in, 20: 43291 (IA-1096)
**RADIATION DETECTION INSTRUMENTS**
abstracts on, 20: 43591(R) (UR-49-687, pp 132-47)
calibration of whole-body gamma, for potassium-40 measurements in man, 20: 42739(R) (COO-1339-3)
dead time correction of counting losses in, device for automatic digital, 20: 43713
development for nuclear measurement, 20: 43764
performance for emergency monitoring, 20: 43589 (STI-PUB-118)
use of whole-body, for measuring long-term calcium metabolism in bones of persons injected with calcium-47 and strontium-85, 20: 42764
**RADIATION DETECTION INSTRUMENTS (PULSE TYPE)**
calibration of large proton-recoil, for measurement of fast neutron spectra, 20: 43669 (CONF-661001-4)
design and performance of, using semiconductor avalanche amplification and tunnel diodes, 20: 43677
design and performance of, using semiconductor detectors, 20: 43739
design and sensitivity of scintillation, for cosmic rays, 20: 43687
design for intermittent light, 20: 43722
design of scintillation, for alpha particles and neutrons, 20: 43750
design using two semiconductor detectors for reaction product analysis, 20: 43717
pulse height spectra from, use of computer for dead time correction of, 20: 43715
sample preparation for, methods of combustion for, 20: 43128
sample preparation for, by combustion method, apparatus for, 20: 43139
use for identification of radioisotopes in mixtures, 20: 42698(R) (ANL-7136, pp 80-94)
**RADIATION DETECTORS**
abstracts on, 20: 43591(R) (UR-49-687, pp 132-47)
bibliography on, Soviet-literature, 20: 43666 (AD-623557)
data from, electronic instruments for processing, 20: 43645
design using interchangable probes, 20: 43750
performance for emergency monitoring, 20: 43589 (STI-PUB-118)
performance for relativistic particles, 20: 43738
use of proportional counters, scintillation detectors, semiconductor detectors and pulse height analyzers in medical research, 20: 43022
**RADIATION EXPOSURE CHAMBERS**
design of radiosterilization device using promethium-147 distributed over a plate, 20: 43796(P)
design of whole-body beta, for mice, 20: 42840(R) (ANL-7136, pp 164-90)
**RADIATION INJURIES**
carcinoma development following radiotherapy of laryngeal papillomatosis in human juveniles, 20: 43023
cellular changes in nervous system during latent period of, 20: 42866
effects of fraction of surviving bone marrow stem cells on lethal, 20: 42844 (BNL-10385)
effects of local, on bone metabolism in rats, 20: 42785
implications for adjudication of compensation claims, 20: 42865
increased rat mucoprotein excretion as expression of radiation-induced general and non-specific mesenchyme reaction, 20: 42960
induced by $\gamma$ rays in rabbit intestinal cells, 20: 42972
induced by radionuclides in oral tissues of experimental animals, 20: 42967
induction of autolysis, in rat muscle tissues, gamma, 20: 42929
measurement of tissue, correlated with dosimetry, 20: 43572 (BNWL-SA-816)
pathology and recovery of hematopoietic system, 20: 42845 (CONF-660543-1)
pathology in rats exposed *in utero* to x rays, 20: 42879
pathology of animal, effects of radiation dose on, 20: 42934
pathology of dog, 20: 42836(R) (ANL-7136, pp 109-23)
pathology of gastric mucosa, $\gamma$, 20: 43019
pathology of mouse testis, $\gamma$ and x, 20: 42942
pathology of, in blood vessels in rabbit brain, microangiographic and histological study of, 20: 42862
pathology of, in carcinomas and cultured carcinoma cells, two-component theory of, 20: 43018
protection against proton, effects of isologous bone marrow injections in mice, 20: 42981
protection against, reaction mechanisms of sulfur and thiol compounds in mice and rats, 20: 42998(R) (EUR-2992.f)
pulmonary sclerosis and functional impairment of human lungs following $\gamma$ radiotherapy, 20: 43030
recovery from, in sheep, swine, and dogs as evaluated by split-dose technique, 20: 42996
recovery from, of mouse bone marrow, 20: 42831 (AD-635600)
recovery kinetics in animals, statistical analysis on, 20: 42829 (AD-635167)
recovery of mice from, $\gamma$ or neutron, mechanisms in, 20: 42833(R) (ANL-7136, pp 16-46)
repair kinetics in cultured hamster cells for, 20: 42841(R) (ANL-7136, pp 266-89)
**RADIATION MONITORING**
developments in neutron, 20: 43671 (ORNL-P-2467)
environmental, of off-gas discharge, 20: 45219
equipment and method for continuous, of surface waters, 20: 43523
equipment design for beta, in Studsvik R2 Reactor, 20: 43688
equipment for, design of filter paper conveyor, 20: 43751(P)
manual on, in emergency situations, 20: 43589 (STI-PUB-118)
methods for total beta, comparison of, 20: 43601
of AEC contractor employees, mortality studies, 20: 42865
program at Savannah River Plant, January to June 1966, 20: 43577(R) (DPST-66-30-2)
sampling method for surface water, 20: 43624
systems for, of surface waters, 20: 43598
use for detecting faults in gloves of personnel manufacturing reactor fuels, 20: 43630
**RADIATION PROTECTION**
bibliography on, Soviet-literature, 20: 43666 (AD-623557)
comparison of theoretical and experimental values of structure shielding against fallout for personnel, 20: 43568 (AD-636787)
determination of strontium-90 contamination levels in East Germany, 20: 43538
dosimetry in, 20: 43572 (BNWL-SA-816)
during therapeutic electron beam exposure, 20: 43012 (BMwF-FBK-66-03)
effects of DNA, RNA, and orotic acid on leukopoiesis in rabbits and rats, 20: 42937
evaluation of one-story and two-story buildings for, against fallout, 20: 43496 (CEX-59.7B(Pt.1))
measures used in hospitals in Russia, 20: 42796
neutron dosimetry for personnel, 20: 43671 (ORNL-P-2467)
program in New Zealand, 20: 43581(R) (NP-16245)
research programs on, in France, 20: 45239(R) (NP-16267)
**RADIATION SICKNESS**
etiology of associated bacteremia, 20: 43052
pathology of, in man and monkeys, 20: 42934
**RADIATION SOURCES**
dosimetry of sealed, 20: 43021
production and uses of, in Romania, 20: 43769
uranium contents of international standard, 20: 43563
use in automatic control instruments in Russia, 20: 43639(T) (AEC-tr-6633)
**RADIATION TARGET CANS**
design for fission product distribution studies, 20: 43996 (LA-DC-7772)
**RADIATION TARGETS**
fabrication for HFIR, equipment development for, 20: 45204 (ORNL-P-2410)
preparation of actinide, 20: 43396
preparation of magnesium-24 from magnesium oxide, 20: 44717
production of polarized proton, 20: 45024
**RADIATORS**
performance of titanate-coated beryllium, niobium–zirconium, and stainless steel, 20: 43816(R) (PWA-2877)
**RADIO ASTRONOMY**
radio source identification and distributions, 20: 44090
**RADIO WAVES**
absorption in ionosphere, cosmic noise method for, (E/T), 20: 44478
absorption in ionosphere during solar eclipse, 20: 44426
absorption in ionosphere during solar eclipse, 20: 44427
absorption of h-f, effects of high-altitude nuclear explosion on, 20: 44479
emission from plasma layers, continuous thermal, (T), 20: 44883
emission from solar flares, correlation with x-ray emission of, 20: 44101
propagation in ionosphere, transmission curves to interpret backscattering echos of, 20: 44428
propagation in plasma in presence of weak gravitational field, (T), 20: 44096
scattering in ionosphere, cosmic particle fallout effects on, 20: 44157
**RADIOACTIVE CONTAMINATION**
bibliography on decontamination methods and equipment, 20: 43569 (AED-C-13-04)
cesium-137 doses to Alaskan Eskimos from fallout, 20: 43622
determination of uranium, by analysis of human urine, 20: 43000

evaluation of, computer program for, 20: 43609
of Black Sea at various levels, 20: 43539
removal of, from structures during postattack period, 20: 43567 (AD-635820)
RADIOACTIVE MATERIALS
analysis for gamma activity, spectrometric method for, 20: 43069(R) (IDO-14679, pp 51-9)
container design for, 20: 43475(P)
dispersal after accidental release, 20: 43589 (STI-PUB-118)
release to environment following accidents at atomic energy facilities, 20: 43589 (STI-PUB-118)
removal from metals using ultrasonics and decontaminating agents, 20: 43623
shipping and storage container for, 20: 43476(P)
RADIOACTIVE MINERALS (COLO.)
aerial survey of Denver area, γ, 20: 43513 (CEX-59.4.26)
RADIOACTIVITY
contamination of surface waters by background, 20: 43598
levels in shielded vessels used for Paramecium cultures, 20: 42886
measurement of alpha and beta, near Andujar uranium installation, 20: 43001
measurement of total beta, in river water, methods for, 20: 43601
measurement of, in natural water, 20: 43124
monitoring environmental iodine-131, from Brookhaven Reactor, 20: 43608
monitoring environmental, at NRTS, Idaho, 20: 45219
monitoring surface water, continuous sampling for, 20: 43523
survey of fallout, in West Germany, 20: 43626
use of natural, in measuring water in snow, 20: 43559
RADIOAPPLICATORS
design of portable strontium-90 γ, 20: 43013(R) (ORO-2459-1)
design of strontium-90 γ, for extra-corporeal blood exposure, 20: 43013(R) (ORO-2459-1)
design of yttrium-90 β, for intraarterial use, 20: 43013(R) (ORO-2459-1)
RADIOBIOLOGY
abstracts on, 20: 42860(R) (UR-49-687, pp 1-65)
gamma-dosimetry in, using ferro-ferrisulfate, 20: 43696
research programs on, in France, 20: 45239(R) (NP-16267)
RADIOCHEMICAL PROCESSING PLANTS
cost calculations for fabrication of oxide fuel elements, 20: 43849 (BNWL-273(Vol.1 and App.)
design study of continuous fluorination-vacuum distillation, for fuel and fertile streams from molten-salt breeder reactor, 20: 43422 (ORNL-3791)
maintenance in Purex, remote-control equipment for, 20: 43417 (ISO-SA-25)
monitoring of, television equipment for, 20: 43472
repairs on large-scale, remote methods for, 20: 43416 (ISO-SA-24)
RADIOCHEMISTRY
analytical methods in, reliability of, 20: 43067(R) (IDO-14679, pp 6-46)
book: *The Radioelements, Factors of Economic Progress*, 20: 43790
cesium-137 determinations in blood fractions, 20: 42778
RADIODIAGNOSIS
evaluation of liver scintigraphy for, 20: 43036
evaluation of lung neoplasm, 20: 43037
legislative control of medical, 20: 43600
methods for, use of ionography and cinedensigraphy, 20: 43028
of tumors in man, 20: 43033
radiation doses to gastrointestinal tract from ingested radioisotope, calculation of, 20: 43043
use of short-lived nuclides for, review, 20: 43022
use of technetium-99-labeled human serum albumins for, of lungs, 20: 43390
RADIOFREQUENCY SPECTROMETERS
design of modified NMR, for improving signal-to-noise ratio, 20: 43640
design of NMR, using superconducting coils, 20: 43685
RADIOGRAPHY
dose to patient during fluoroscope, parameters affecting, 20: 43050
dosimetry during medical, using lithium fluoride thermoluminescent detectors, 20: 43747
localization of lung neoplasms by, compared with other diagnostic methods, 20: 43037
of blood vessels in irradiated rabbit brain, microangiographic, 20: 42862
of hot-rolled metal ingots, 20: 43870
radiation doses to human gonads from diagnostic, calculation procedure for, 20: 43026
radiation sources for use in, preparation of iron-55, 20: 43384
resolution limits in, effect of radiation attenuation on, 20: 43494
theoretical bases and practical applications of techniques, 20: 43616
use of lipiodol for renal veins, 20: 43024
use of transverse tomography for dosimetry of sealed radioisotope implants, 20: 43021
RADIOISOTOPE SUBMERSIBLE ENGINE
fuel specifications for, 20: 43797 (AGN-8163(Vol.3))
power conversion system for, design and performance of, 20: 43799 (NP-16281)
RADIOISOTOPES
activity of, use of G-M counter for determination of absolute beta, 20: 43697
behavior in Clinch River sediments, 20: 45216 (ORNL-3721)
beta-particle energies of, tables of maximum, 20: 44655 (SZS-4/66)
book: *The Radioelements, Factors of Economic Progress*, 20: 43790
content and transport in Elbe River, 20: 45225
content in bottom sediments of Clinch River, 20: 45223
content in Mediterranean Sea, effects of season, temperature, and Nile River flooding on, 20: 43508(R) (NP-16179)
content in waste tanks at NRTS, 20: 45219
costs of RISE, effect of power conversion efficiency on, 20: 43799 (NP-16281)
decay of, systematics of energy release in, 20: 44821
deposition of, design of cell for electrolytic, 20: 43395
determination by least-squares resolution of gamma spectra, computer program for, 20: 43078 (ORNL-3975)
determination of beta-emitting, by scintillation counter, 20: 43098
determination of recoil atoms of short-lived, by measurements of diffusion in tantalum plate, 20: 43073 (JINR-P-2804)
distribution in bottom sediments of Clinch and Tennessee Rivers, 20: 45216 (ORNL-3721)
effects of extrinsic organ compression of uptake of, by liver, 20: 43036
fixation by muds, 20: 43544
identification in mixtures from counting data, 20: 42698(R) (ANL-7136, pp 80-94)
late effects on humans, 20: 42865
nuclear properties of, systematics of, 20: 44820
preparation of, electrolytic cell for deposition in, 20: 43395
production and industrial uses of, bibliography on, 20: 43757 (ORNL-TM-1505(Pt.2))
production and uses of, in Romania, 20: 43769
production by (γ,n) reactions with elements and compounds, (E), 20: 44681
production in underground nuclear explosions, 20: 43802
production of, review of improvements in, 20: 43399
production of, survey of developments in commercial, 20: 43803
research on uses of, in France, 20: 45239(R) (NP-16267)
role in soil organic matter research, 20: 42795
sorption from waste solutions by Yazoo and Zilpha clays, 20: 45221
standardization of, compilation of gamma spectra for, 20: 43380 (ORNL-P-2432)
toxicity of, abstracts on, 20: 42746(R) (UR-49-687, pp 66-116)
use for control of industrial processes, 20: 43789
use for thickness measurements for metals, 20: 43642
use in hydrology, survey of, 20: 43555
use in liquid level control in casting steel, 20: 43761
use in measuring frictional wear, 20: 43788
use in medicine, 20: 43051
use of short-lived, in medical research, diagnosis and therapy, review, 20: 43022
uses in Canada, industrial, 20: 43763
uses in construction problems, 20: 43762
uses in veterinary medicine, 20: 42723
RADIOLOGICAL DEFENSE
decontamination of structures, requirements for, 20: 43567 (AD-635820)
RADIOLOGICAL TELEMETERING SYSTEMS
use for ultracentrifuge rotor temperature and speed measurement, 20: 43637(R) (UCRL-16246, pp 168-75)
RADIOLOGICAL WARFARE
hazards of, to U. S. populations, 20: 43566 (AD-625251)
RADIOLOGICAL WEAPONS
hazards to populations from, 20: 43566 (AD-625251)
RADIOLOGY
radiation effects on radiologists and technicians, 20: 42865
RADIOMETERS
use for measuring water flow rates, 20: 43662
RADIOMETRIC ANALYSIS
method of, using pulsed neutrons, 20: 43163(P)
RADIOMIMETIC SUBSTANCES
effects of nitrogen mustard on DNA molecule, site and mechanism of action, 20: 42821
effects on development of autoimmunity following therapeutic use of, 20: 43027
RADIOOPAQUE AGENTS
effects of iodine-131-labeled ethiodol, on human lymph systems, 20: 42976
labeling with iodine-131, 20: 43397
RADIOPROTECTIVE COMPOUNDS

biochemical effects on mice and rats, 20: 42998(R) (EUR-2992.f)
comparative effects of mercaptoalkylamines and indolylalkylamines against gamma rays and proton beams, 20: 43002
comparison of iproniazid and serotonin, in mice, 20: 42991
testing of lysozyme as, in rats exposed to x radiation, 20: 42993
use of apilac (bee secretion) in experiments on mice, rats and rabbits, 20: 43009

**RADIOSENSITIVITY**
effects of acridine dyes and oxygen on *Escherichia coli* uv, 20: 42838(R) (ANL-7136, pp 140-54)
effects of physiological factors on, bibliographic study, 20: 42849 (NP-16258)
effects of 5-bromodesoxyuridine on, 20: 42776
of bone marrow, gonads, and gastrointestinal tract, comparison with other organs of body, 20: 42865
of mouse tumor cells, *in vitro* and *in vivo* studies, 20: 42888
of pectic enzymes of fungal origin used in processing fruit juice, 20: 43785
of tumors in man, 20: 43033
organs of various animals, 20: 43625
seasonal variations in rabbit, γ, 20: 42848 (NP-16256)
temperature effects on, in rats, 20: 42959

**RADIOSENSITIZERS**
effects of chemical, on gamma sensitivity of spores of food-spoilage fungi and yeasts, 20: 43784

**RADIOSTERILIZATION**
design of device using promethium-147 particles uniformly distributed on plates, 20: 43796(P)
effects of fish, on microbial assays on refrigerated fillets, γ, 20: 43793
effects of gamma, on storage life of berries and fruits, 20: 43782
effects on control of insect infestation in stored fruits and vegetables, 20: 43780
effects on flavor, storage life, and wholesomeness of fruits and vegetables, 20: 43781
effects on food toxicity, 20: 43771
effects on food toxicity, 20: 43772
effects on meat, vitamin metabolism studies, 20: 42793
effects on storage life of fish, 20: 43775
effects on storage life and taste of fish and sea foods, fresh, cooked, pickled, smoked, and salted, using gamma radiation, 20: 43776
effects on storage life of fruits and vegetables, 20: 43783
effects on storage life of fruits, 20: 43784
effects on storage life of fruit juices, 20: 43787
feasibility of bark beetle, for population control, 20: 42883
meats treated by, consumer acceptance and organoleptic tests on, 20: 43795
mechanism for effects of, on plant texture, 20: 42815
of fish, economic factors in developing countries, 20: 43775
of insects infesting dried or smoked fish, 20: 43777
of insects infesting dried or smoked fish, 20: 43778
of sea foods, using gamma radiation, 20: 43774
off-odors and flavors produced in meats by, 20: 42973
processing of oranges by electrons, 20: 43794
recommendations of FAO/WHO/IAEA on foods, 20: 43786
screw-worm fly, effectiveness of chemosterilants compared with γ, 20: 42724
use in control of insects infesting stored grains, 20: 42904

**RADIOTHERAPY**
abdominal tumor, effects on water-electrolyte metabolism on, 20: 42994
abdominal tumor, induction of enterocolitis by, 20: 42994
carcinoma development following, laryngeal papillomatosis, 20: 43023
developments in neutron-capture, 20: 42840(R) (ANL-7136, pp 164-90)
dosimetry for sealed-source, surface, interstitial, and intercavitary, 20: 43021
effects of cancer, on erythropoietic index and iron content, 20: 42908
effects of cancer, on lymphatic dynamics, lymph nodes, and lymph vessels, 20: 42976
effects of γ, lumbar lymph node, 20: 43019
effects of thyroid, on thyroid cell nuclei and function and on circulating leukocytes, 20: 42857(R) (TID-23228)
effects on serum and urine β-glucuronidase, 20: 43025
efficiency of telecobalt, for castration in human females, 20: 43044
evaluation of, for bone, lung, and lymph node metastases, 20: 43038
induction of chromosome aberrations by cancer, 20: 42931
legislative control of, 20: 43600
methods for skin metastases, 20: 43039
of malignant tumors of testis, advantages and limitations, 20: 43034
of pharyngeal cancers, technique and dose distribution for x, 20: 43020
of tumors in man, 20: 43033
patient alignment techniques for pituitary alpha, 20: 43017(R) (UCRL-16246, pp 66-73)
pulmonary sclerosis and functional impairment of lungs following bronchogenic cancer γ, 20: 43030
radiation dose measurements for, phantom for determining, 20: 43053(P)
radiation doses to gastrointestinal tract from ingested radioisotope, calculation of, 20: 43043
radioinduced autoimmunity following x, 20: 43027
radium implant techniques, dose calculations using cranium phantom, 20: 43616
techniques for testicular, following orchiectomy, 20: 43038
use of high-energy electron beam, for bronchial carcinoma, 20: 43018
use of short-lived nuclides for, review, 20: 43022
use of thorium X in dermatology and spondylitis, 20: 43046

**RADIOTOXICITY**
abstracts on studies of, 20: 42746(R) (UR-49-687, pp 66-116)

**RADIUM**
content in rainwater, method for determination, 20: 43529
effects of therapeutic use on excretion of β-glucuronidase, 20: 43025
gamma dose distributions from, in pelvis, 20: 43047
localization of radiation sources for dose calculations in interstitial therapy, 20: 43616
use for therapy of pharyngeal cancers, 20: 43042

**RADIUM ISOTOPES**
energy levels of, rotational, (T), 20: 44843

**RADIUM ISOTOPES Ra-224**
therapeutic effects on skin diseases and spondylitis, 20: 43046

**RADIUM ISOTOPES Ra-226**
content in man, estimation from radon exhalation, 20: 43604
content in plants and animals of arctic region, 20: 43005
content in rainwater in Calcutta, India, 20: 43529
detection in surface water by spectrometry, 20: 43544
effects of naturally occurring, on environmental radioactivity in New Zealand, 1965, 20: 43581(R) (NP-16245)
radiation dose calculations, comparison with radium-224 and thorotrast, 20: 43046
uptake by vegetables and cereals, relation to soil content, 20: 42792

**RADIUM ISOTOPES Ra-228**
determination in monazite-processing wastes, 20: 43442
radiation dose from, to bones of rodents in Minas Gerais, Brazil, 20: 43606
use as standard in radon-220 determination, 20: 43525

**RADON**
hazards from inhalation of, in uranium mines, 20: 43617
monitoring of short-lived decay products of, in uranium mines, 20: 43594(T) (AEC-tr-6763)
sorption on aerosols, mathematical analysis of diffusion parameters affecting, 20: 43167 (BMwF-FBK-66-11)

**RADON ISOTOPES Rn-220**
content in atmosphere of working premises, MPC of, 20: 43603
content in atmosphere below 50 cm, 20: 43543
determination of airborne, method for, 20: 43525
diffusion from soil surfaces, 20: 43543
radiation dose from, to lungs of rodents in Minas Gerais, Brazil, 20: 43606

**RADON ISOTOPES Rn-222**
determination of airborne, method for, 20: 43525
effects of naturally occurring, on environmental radioactivity in New Zealand, 1965, 20: 43581(R) (NP-16245)
radiation dose from, to lungs of rodents in Minas Gerais, Brazil, 20: 43606
sorption on aerosols, mathematical analysis of diffusion parameters affecting, 20: 43167 (BMwF-FBK-66-11)
uptake through skin of rats, 20: 42790

**RAIN WATER**
cesium-137 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
determination of fallout in, in New Zealand from 1956 to 1959, 20: 43530
radioactivity of, method for measurement of, 20: 43124
radium content of, method for measuring, 20: 43529
sampling for fallout analysis, 20: 42850(R) (NYO-2043-130)
sodium-23 and -24 content of, 1962-4, 20: 43546
strontium-90 content in, in Belo Horizonte, Brazil, 20: 42999 (NP-15934)
strontium-90 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)

**RAMAN EFFECT**
scattering in uranium dioxide, 20: 45015
spectra line intensity in, properties of, 20: 44148

**RARE EARTH ALLOYS**
Al–rare earth, properties of intermetallic compounds in, tabulation of, 20: 43972

**RARE EARTH CHLORIDES**
covalency in, 20: 43241

**RARE EARTH COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with racemic 2,3-diaminobutane-N,N,N',N'-tetraacetic acid, stability con-

stants of, polarographic studies of, 20: 43204
with TTA and TOPO, preparation and properties of, 20: 43100

**RARE EARTH IONS**
effects on lithium niobates, doping, 20: 43242
fluorescence of trivalent, in sodium tungstate solution, 20: 43211
fluorescence of trivalent, in potassium oxalate solution, 20: 43212
fluorescence of, in sodium tungstate solution, effects of pH, concentration, temperature, and time on, 20: 43210

**RARE EARTH OXIDES**
analysis for terbium, using antipyrine-salicylate complexes, fluorometric, 20: 43256

**RARE EARTH PERRHENATES**
preparation and properties of, 20: 43217

**RARE EARTH SULFIDES**
properties and structure of, 20: 43264

**RARE EARTH THIOCYANATES**
separation of, effect of different solvent mixtures on paper chromatographic, 20: 43452

**RARE EARTHS**
analysis of, for yttrium, fluorimetric, 20: 43150
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
determination as solid or solution, silver spark method for spectrochemical, 20: 43068(R) (IDO-14679, pp 47-50)
determination in Gulf of Mexico by cation exchange, 20: 43087(R) (TID-23295, Sect.4)
determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
determination of, using mixtures of TTA and TOPO, spectrophotometric, 20: 43100
determination of, in presence of uranium(VI) using halogenomandelic acids, 20: 43141
effects on phase transformation temperatures of cerium, 20: 45011
electric-dipole transitions in, operator for spin-forbidden, 20: 44124
energy levels of, interaction between rotational and vibrational, (T), 20: 44694
energy-level transitions in deformed, E2, (E), 20: 44701
preparation and uses of, 20: 43264
preparation of carrier-free tetravalent, by sorption by iodates, 20: 43448
properties as neutron poison, annotated bibliography on, 20: 45080
separation from irradiated plutonium, 20: 43067(R) (IDO-14679, pp 6-46)
separation of dysprosium from, as chloromandelate, 20: 43140
separation of protactinium from, by sorption on activated charcoal, 20: 43148
separation of tetra- from ter- and hexavalent, by sorption in iodates, 20: 43448
separation of, by paper chromatography, effects of different solvent mixtures on, 20: 43452
separation of, from thorium in sulfuric acid solutions by ion exchange, 20: 43147
separation of, in hydrochloric acid solution using triisoöctylamine, ion-exchange, 20: 43439
spectra in flames, effects of chlorine on, 20: 43152

**RARE GASES**
ionization by alpha particles and electrons, cross sections and mass spectra of, (E), 20: 44122

**RATE METERS**
design and specification of transistorized, 20: 43728

**RATS**
amyloid content of intestine and obstruction in, 20: 42835(R) (ANL-7136, pp 63-80)
carcinogenesis in, combined effects of fission neutrons and 2,7-diacetylaminofluorene on, 20: 42840(R) (ANL-7136, pp 164-90)
cesium metabolism in, comparison with other mammals, 20: 42768
cesium-137 excretion from, effects of Berlin Blue on, 20: 42786
effects of bone marrow transplantation on lethally irradiated, 20: 42956
effects of dietary casein levels on gamma-induced liver changes, 20: 42864
effects of ionizing radiation on zinc content of pancreas, 20: 42917
effects of mercamine on bactericidal activity of irradiated blood serum, 20: 43003
electrophoretic behavior and sialic acid release in erythrocytes from, effects of bacterial α-amylase on, 20: 42714 (UCRL-16246, pp 119-25)
etiology and pathology of glomerulonephritis in, 20: 42855(R) (TID-23203)
gastrointestinal transit time in, for ceramic spheres containing manganese-54 or uranium carbide particles, 20: 42740 (LA-DC-7764)
horseradish peroxidase effects on t-RNA activity of liver, 20: 42809
immune reactions in, measurement of, 20: 42835(R) (ANL-7136, pp 63-80)
iodine metabolism in, effects of simulated altitude on, 20: 42745(R) (UCRL-16246, pp 126-37)
liver slices of, sodium ion efflux from, 20: 42758
phosphorus-32 distribution in tissues of, after inhalation or oral administration, 20: 42783
plutonium carcinogenicity and metabolism in, 20: 42997(R) (ANL-7136, pp 191-204)
potassium metabolism in, comparison with other mammals, 20: 42768
protective effects of post-irradiation oxygen starvation in thymocytes of, against x-ray induced nuclear damage, 20: 42989
radiation dose effects on erythropoiesis, x, 20: 42957
radiation dose effects on thyroid metabolism, 20: 43029
radiation effect on conditioned response of, γ and x, 20: 42852(R) (ORO-2903-28)
radiation effects on bone metabolism, x, 20: 42785
radiation effects on metabolism in bone marrow and peripheral blood of whole-body irradiated, x, 20: 42788
radiation effects on glycoproteins and hexoses in hyperthyroid, x, 20: 42805
radiation effects on thymidine catabolism in, x, 20: 42806
radiation effects on urinary excretion of aminoisobutyric acid, deoxyuridine, and thymidine, 20: 42807
radiation effects on fatty acid peroxide-induced atherosclerosis in aorta of, 20: 42813
radiation effects on fatty acid peroxide-production in the livers of, 20: 42813
radiation effects on metabolism of 5-iododeoxyuridine in, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on antibody synthesis in, x, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on antigen localization in, x, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on carcinogenicity of plastic implants in, effects of exposure time on x, 20: 42840(R) (ANL-7136, pp 164-90)
radiation effects of implanted β sources on, carcinogenic, 20: 42840(R) (ANL-7136, pp 164-90)
radiation effects on bone marrow stem cells in, effects on survival after exposure to lethal doses of x, 20: 42844 (BNL-10385)
radiation effects on glucose metabolism in, x, 20: 42856 (TID-23213)
radiation effects on DNA synthesis in thyroid of, β, 20: 42857(R) (TID-23228)
radiation effects on bone marrow, hemopoietic regeneration following x, 20: 42871
radiation effects on development of, exposed *in utero* to x, 20: 42879
radiation effects on uptake of heat-killed sulfur-35-labeled mycobacterial vaccine by microsomes and mitochondria in spleen of, x, 20: 42907
radiation effects on thymocyte nuclei, effect of phosphate metabolism and respiration on x, 20: 42928
radiation effects on electric conductivity in muscle tissues of, gamma, 20: 42929
radiation effects on insulin distribution in, tracer study of x, 20: 42932
radiation effects on lysozyme activity in serum of, x, 20: 42944
radiation effects on, as affected by diurnal variations, 20: 43048
radiation effects on leukocytes of, from deposited β, 20: 42948
radiation effects on blood chemical constituents, whole-body x, 20: 42955
radiation effects on hyperthermia, x, 20: 42959
radiation effects on urinary excretion of mucoproteins, whole-body x, 20: 42960
radiation effects on spermatogenesis in, following head exposure, x, 20: 42961
radiation effects on growth of Yoshida ascites sarcoma, x, 20: 42962
radiation effects on intestinal reactivity in, to parasympathomimetic substances, 20: 42964
radiation effects on leukocyte counts in, administered endoxan, x, 20: 42965
radiation effects on gastrointestinal absorption of water in, x, 20: 42971
radiation effects on microcirculation in mesentery of, response to serotonin following x, 20: 42978
radiation effects on, testing of lysozyme as possible protectant against x, 20: 42993
radiation effects on, protective effects of barbamyl and serotonin against, 20: 43008
radiation effects on, protective effects of apilac and cystamine against x, 20: 43009
radiation effects on survival time, following infrared-induced hyperthermia, x, 20: 42959
radiation injuries to oral tissues in, following subcutaneous injection of radionuclides, 20: 42967
radioinduced autolysis in muscle tissues of, gamma, 20: 42929
radioinduced carcinogenesis in mammary epithelium of, relation of DNA synthesis to x, 20: 42840(R) (ANL-7136, pp 164-90)
radioinduced chromosome aberrations in continuously irradiated bone marrow, dose effect studies, 20: 42951
radioinduced creatine excretion in adrenalectomized, γ, 20: 42801
radioinduced tumors in, injected plutonium-239, 20: 42840(R) (ANL-7136, pp 164-90)

radioiodination of tissue-soluble proteins in, using chloramine T, 20: 43274
radioprotective effects of DNA, RNA, and orotic acid on leukopoiesis, 20: 42937
radioprotective effects of sulfur and thiol compounds on, reaction mechanisms of, 20: 42998(R) (EUR-2992.f)
radiosensitivity of, effects of olfactory bulb on, 20: 42852(R) (ORO-2903-28)
radiosensitizing effects of 5-bromodesoxyuridine on Walker's adenosarcoma, Ehrlich ascites tumor, and hepatoma, 20: 42776
radon-222 diffusion through skin of, as affected by temperature and uv-irradiation, 20: 42790
sodium ion efflux mechanisms in liver of, 20: 42759
ultrasonic decontamination of radioisotope-contaminated skin of, 20: 42811
ultraviolet radiation effects on t-RNA activity of liver, 20: 42809
zinc-65 retention in, effects of calcium- and zinc-chelates of EDTA and DPTA on, 20: 42789

**REACTION MECHANISMS**
calculations for, classical trajectory and quantum mechanical, 20: 43288(R) (CALT-532-1)
cross sections and thermal rate constants for, 20: 43288(R) (CALT-532-1)

**REACTOR COMPONENTS**
fabrication and installation of piping-system, 20: 45119 (SWRI-1228-7-34)
vibration of, solution for nonlinear, 20: 45061

**REACTOR CONTROL ELEMENTS**
loading device for AVR spherical, 20: 45139

**REACTOR CONTROL RODS**
calibration in ATRC, 20: 45046(R) (IDO-17192)
drive system for, design of actuator package for, 20: 45190 (DP-670)
reactivity worths in ATRC, 20: 45046(R) (IDO-17192)

**REACTOR CONTROL SYSTEMS**
performance of SNAP, computer program for calculating, 20: 45196 (NAA-SR-Memo-11894)
shutdown equipment for AVR, operation of, 20: 45138
simulation of Fermi, by analog computer, 20: 45168

**REACTOR COOLANTS**
flow in multirod fuel bundles, 20: 45051 (RISO-125)
hydrogenation regeneration of decomposed gas-oil, device for, 20: 43271 (IAE-1066)
processing Dragon, 20: 45114(R) (NP-16272)
purification system for AVR, description of, 20: 45142

**REACTOR COOLING SYSTEMS**
coolant blowers in AVR, description of, 20: 45141
flow instabilities in Halden fuel assemblies, 20: 45111(R) (HPR-68)
monitoring for beta activity, 20: 43688
simulation of Fermi, by analog computer, 20: 45168

**REACTOR ENGINEERING**
nuclear data for reactor calculations, preparation of, 20: 44583 (NAA-SR-11980(Vol.1))
research programs at Chalk River on, 20: 45234 (AECL-2460)
research programs on, in France, 20: 45239(R) (NP-16267)

**REACTOR FUEL ALLOYS**
development and testing of liquid plutonium–cobalt–cerium, 20: 43814 (LA-DC-7581)
irradiation capsule for molten plutonium, design of, 20: 43996 (LA-DC-7772)

**REACTOR FUEL ELEMENTS**
analysis for uranium, titrimetric, 20: 43067(R) (IDO-14679, pp 6-46)
burnup of, gamma scanning for determination of, 20: 45111(R) (HPR-68)
cladding for Yankee, analysis of corrosion products from, 20: 45126 (WCAP-6072)
cleaning of Garigliano, 20: 45121(R) (TID-23320)
development for Halden reactor, 20: 45111(R) (HPR-68)
development of ATR, thermal stress analysis, 20: 45046(R) (IDO-17192)
fabrication cost calculations for pellet and vibrational-compacted oxide, enriched with uranium-235 or plutonium, 20: 43849 (BNWL-273 (Vol. 1 and App.)
fabrication costs of oxide, effects of variables on, 20: 45095 (BNWL-273(Vol.3))
failure detection system for Halden, performance of, 20: 45111(R) (HPR-68)
failure of Zircaloy-clad uranium, in autoclave steam testing, 20: 43828 (HW-66911)
gamma heating effects on cylindrical, 20: 45050 (ORNL-TM-1260)
handling machine for DON, power cell design for, 20: 45163
handling system for DON, hook mechanism design and testing, 20: 45162
heat transfer from roughened surfaces of gas-cooled, 20: 43487
heat transfer from roughened surfaces of gas-cooled, 20: 43488
heat transfer in rod-bundle, in longitudinally flowing gases, 20: 43489
hydraulic characteristics of Halden assemblies, 20: 45111(R) (HPR-68)
hydrodynamic coupling in Halden assemblies, 20: 45111(R) (HPR-68)
irradiation testing of Halden assemblies, 20: 45111(R) (HPR-68)
processing of irradiated, radiation doses in criticality incident of $10^{17}$ fissions in, 20: 43421 (NP-16216)
processing of irradiated, economic aspects of, 20: 43435
properties of EK-10 type for WWR, improvement of thermodynamic, 20: 45210
radiation effects on dimensional stability of cylindrical solid, stress analysis in unsteady state conditions, (E/T), 20: 44017
simulation of, sheathed heater design for, 20: 43465 (AECL-2592)
testing of collapsed clad, in supercritical water-cooled loops, 20: 45098(R) (WCAP-3374-4)
testing of magnesium alloys for, fatigue, 20: 43957

**REACTOR FUEL ELEMENTS (CERAMIC)**
fabrication for Re-Suco critical assembly, 20: 43872
fabrication of plutonia-containing, quality control of, 20: 43869
radiation effects on plutonium–uranium nitride, 20: 43988(R) (BNWL-269, pp 2.1-11)
radiation effects on defected-clad, at high exposures, 20: 43989(R) (BNWL-269, pp 3.1-30)
thermal conductivity of ETR-MTR-type, 20: 43811(R) (BNWL-269, pp 1.1-28)

**REACTOR FUEL ELEMENTS (DISPERSION)**
fabrication and properties of coated particles–graphite matrix, for UHTREX, 20: 43855 (LA-DC-6954)
fabrication of aluminum–uranium oxides, 20: 43844 (AAEC-TM-315)
fabrication of, using uranium aluminide, 20: 43822

**REACTOR FUEL PINS**
performance of, in gas-cooled fast reactors, 20: 45117 (ORNL-TM-1194)
radiation testing of uranium carbide and uranium dioxide, 20: 45097(R) (WCAP-2972)

**REACTOR FUEL PLATES**
fabrication of aluminum–uranium oxides of, 20: 43844 (AAEC-TM-315)
thermal conductivity of ETR-MTR-type, 20: 43811(R) (BNWL-269, pp 1.1-28)

**REACTOR FUEL RODS**
coolant mixing in multirod bundles, 20: 45051 (RISO-125)
fabrication from recycled uranium, pilot plant for, 20: 45094(R) (BAW-3460-2)
fabrication of uranium dioxide, for fast reactors, 20: 45100
instrumentation of, for operating pressure measurement, 20: 43989(R) (BNWL-269, pp 3.1-30)
performance of defected, in ETR, 20: 43988(R) (BNWL-269, pp 2.1-11)
temperature measurements in BORAX-V, 20: 45209

**REACTOR FUEL SPHERES**
fabrication of AVR, 20: 45135
fabrication of urania, for Re-Suco critical assembly, 20: 43872
loading device for AVR, 20: 45139
loading equipment for AVR, control devices for, 20: 45140
production of uranium carbide, by graphite–urania reactions, 20: 43876
testing of AVR, 20: 45135

**REACTOR FUEL TUBES**
cladding expansion, equipment for measuring, 20: 43960
fabrication of aluminum-clad thorium, 20: 43861 (TID-12860)
sonic inspection, 20: 43812(R) (BNWL-269, pp 4.1-9)

**REACTOR FUELS**
analysis for gamma activity, equipment and methods for, 20: 43074 (LA-DC-7831)
analysis of 10-day cooled samples of, for fission products, 20: 43067(R) (IDO-14679, pp 6-46)
book: *Nuclear Fuels*, in French, 20: 45099
burnup analysis of, computer program for, 20: 45111(R) (HPR-68)
burnup of, perturbation calculations for, 20: 45067 (CONF-660303, pp 259-69)
burnup, method for determining, 20: 43067(R) (IDO-14679, pp 6-46)
compatability of SAP with uranium-base, 20: 43835 (RISO-91)
cycle analysis for British A.G.R. and S.G.H.W., 20: 45180
cycle analysis for organic-cooled heavy water reactors, 20: 45185
cycles using thorium and uranium, economics of crossed-progeny, 20: 45096 (BNWL-289)
development for Dragon reactor, 20: 45114(R) (NP-16272)
development for liquid metal fast breeder reactors, 20: 45106(R) (ANL-7249)
dissolution of, containing calcium, uranium, and zirconium oxides, method for, 20: 43069(R) (IDO-14679, pp 51-9)
distribution in reactors, heat output shaping by nonuniform, 20: 45208
fabrication and evaluation of coated uranium–thorium–carbide particulate, for high-temperature gas-cooled reactors, 20: 43860 (SGAE-CH-35/1966)
fabrication of coated particles for UHTREX, 20: 43855 (LA-DC-6954)
manufacture of plutonium oxide/uranium oxide, health hazards from, 20: 43630
performance of natural uranium, plutonium-240 and uranium-238 effects on, 20: 45103 (AECL-2590)

- processing carbide, metal, and oxide fast-breeder, by aqueous, pyrochemical, and volatility methods, economics of, 20: 43410 (ANL-7137)
- processing of irradiated, problems in chemical and gaseous, 20: 43413 (EURAEC-1659)
- processing of particulate, review of fluid-bed, 20: 43868
- procurement and processing of plutonium, for German fast breeder prototype reactors, economics of, 20: 45151
- production for power reactors, estimates for 1970–1985, 20: 45118 (RISO-M-434)
- production of enriched uranium oxide, in Britain, 20: 43874
- production of plutonium, in Britain, 20: 43875
- properties of urania-base ceramic, 20: 43900(R) (NBS-D-150)
- research programs on, in France, 20: 45239(R) (NP-16267)
- separation of silica and silicon from, by dissolution and sand filtration, 20: 43426 (ORNL-TM-1650)

**REACTOR MATERIALS**
- research programs on, in France, 20: 45239(R) (NP-16267)
- testing of pressure vessel, 20: 45120 (SWRI-1228-7-35)

**REACTOR MATRICES**
- neutron multiplication factor measurement in, method for, 20: 45078 (MIT-2344-6)
- reactivity transfer functions for SHE, measurement using pulsed neutrons, 20: 45082

**REACTOR MODERATORS**
- loading device for AVR spherical elements, 20: 45139

**REACTOR REFLECTORS**
- neutron radial buckling in, determination of, 20: 45085

**REACTOR SAFETY**
- containment building atmosphere analysis for hydrocarbons, equipment for, 20: 43068(R) (IDO-14679, pp 47-50)
- containment for EDF-3 and EDF-4, 20: 45127(T) (ORNL-tr-1228)
- containment for gas-cooled fast reactors, optimization of secondary, 20: 45117 (ORNL-TM-1194)
- fission product release in accidents, methyl iodide removal methods, 20: 45049 (ORNL-P-2431)
- iodine deposition in accidents, analysis of, 20: 45045(R) (BMI-X-10173)
- iodine deposition, use of composite diffusion tubes to study, 20: 43582 (ORNL-3985)
- methyl iodide formation under accident conditions in, chemical equilibrium studies of, 20: 43166 (BMI-1781)
- neutron cross section uncertainty effects on, 20: 45068 (CONF-660303, pp 430-53)
- site evaluation criteria, 20: 45054
- systems for, descriptions of AVR, 20: 45143

**REACTOR SAFETY EXPERIMENTS**
- metal–water reactions in TREAT meltdown, 20: 45106(R) (ANL-7249)
- metal–water reactions in LOFT, Zircaloy-4 effects on, 20: 45112 (IDO-17168)

**REACTOR SHIELDING**
- weight scaling factors for SNAP, 20: 45197 (NAA-SR-Memo-11971)

**REACTOR TUBES**
- fabrication of pressure, for fuel element testing, 20: 45098(R) (WCAP-3374-4)
- fabrication of Zircaloy-4-clad zirconium–2.5 niobium pressure, 20: 43862 (TID-23312)

**REACTORS**
- book: *Optimal Shutdown Control of Nuclear Reactors*, 20: 45093
- calorimeter for, design of steady-state differential, 20: 43663
- criticality of, calculations using topological methods, 20: 45079
- description of U. S. facilities, 20: 45052 (TID-8200(14th Rev.))
- design of externally moderated chemonuclear, 20: 43300
- design of, neutron cross section requirements for, 20: 45070 (CONF-660303, pp 823-39)
- development of advanced-type, in European community, 20: 45165
- environmental radiation from, in West Germany, 20: 43626
- instrument modules for, standard, 20: 43664
- instrumentation for, design and performance of fission and ionization chamber, 20: 43716
- monitoring of, television equipment for, 20: 43472
- neutron capture-to-fission ratios in low-flux, 20: 45071 (CONF-660303, pp 1092-7)
- neutron distribution in, correlation theory calculations of, 20: 45053
- neutron fluctuations in, space and energy dependence of, 20: 45081
- neutron poisons for, annotated bibliography of, 20: 45080
- neutron radial buckling in reflected, determination of, (T), 20: 45085
- operation of, in France, 20: 45239(R) (NP-16267)
- physics analysis of liquid-moderated, computer program for, 20: 45063 (AEEW-R-480)
- physics of, matrix theory applications in, 20: 45058
- power spectral density for, bias in estimates for, 20: 45091
- pressure tubes for, properties of compressed powders for insulating, 20: 45056
- reactivity noise in, Langevin technique for analysis of space- and energy-dependent, 20: 45086
- reactivity of, annular void effects on, 20: 45072 (GEMP-424)
- reactivity of, effect of neutron scattering model on calculated parameters for, 20: 45065 (CONF-660303, pp 146-50)
- shutdown of, effect of gamma fluxes on margin measurements, 20: 45048 (ORNL-P-2311)
- site evaluation for, criteria comparisons of, 20: 45054
- stability of, criteria for nonlinear, (E/T), 20: 45087
- steam generation in, temperature-enthalpy diagram for analysis of, 20: 45174

**REDOX PROCESS**
- plant for, remote equipment and methods for repairs in, 20: 43416 (ISO-SA-24)

**REFLECTOR MODERATED REACTORS**
- design of tungsten-based, beryllium, for rocket propulsion, 20: 45199

**REFRACTORY MATERIALS**
- properties at high temperatures, bibliography on, 20: 43903 (NP-16238)
- properties of alloyed metallic, for high-temperature oxidizing atmospheres, 20: 43842
- thermodynamics of high-temperature, 20: 43913 (UCRL-16256)

**REGENERATION**
- mechanism of lymphoid, in x-irradiated mice, 20: 42984

**RELATIVITY THEORY**
- book: *The Quantum Equation and the Theory of Fields*, 20: 44401
- Doppler measurement of space-time curvature in, 20: 44485
- Einstein effects in, mechanics of, 20: 44489
- Einstein-Maxwell, two-body problem in, 20: 44483
- energy-momentum complex in general, 20: 44487
- gravitation in general, review of, 20: 44498
- gravitational collapse of quasars, irreversibility of, 20: 44082
- gravitational waves in, conservation of, 20: 44496
- Lorentz invariants in, properties of, 20: 44482
- particle models in, field equations for spin, 20: 44481
- properties of rotating fluid masses in general, 20: 44495
- singularities in general, model of universe from, 20: 44493
- singularities of space-time in general, 20: 44492
- time reversal in, 20: 44193
- use for thermodynamic calculations, 20: 44036

**RELAYS**
- catalog of Russian radiometric, 20: 43639(T) (AEC-tr-6633)

**REMOTE-CONTROL EQUIPMENT**
- bellows for, design of, 20: 43069(R) (IDO-14679, pp 51-9)
- bibliography on, Soviet-literature, 20: 43666 (AD-623557)
- design, 20: 43067(R) (IDO-14679, pp 6-46)
- development of hydraulic bolt cutter for irradiation capsules, 20: 43470 (UCRL-14743)
- development of, for fabrication of HFIR target elements, 20: 45204 (ORNL-P-2410)
- fabrication and installation of, for Transuranium Processing Plant, 20: 43425 (ORNL-P-2406)
- maintenance in large Purex Separations plant, 20: 43417 (ISO-SA-25)
- use for repairs on large scale separation plants, 20: 43416 (ISO-SA-24)

**REPTILES**
- effects of Project Sedan explosions on ecology of lizard, 20: 42732

**RESEARCH REACTORS**
- description of the TRIGA Mark II, at Ljubljana, 20: 45212
- description of U. S. facilities, 20: 45052 (TID-8200(14th Rev.))
- fuel rods for BORAX-V, thermal conductance values of, 20: 45209
- fuel temperature measurements in BORAX-V, 20: 45209
- kinetics of JRR-3, analog and digital analysis of pseudo-random binary signals for, 20: 45213
- site selection for Argonaut-type, near Guanabara, Brazil, 20: 43548
- utilization of, conference on, 20: 45206 (ORO-3191-1)
- waste processing at Rospo and Ispra-2, 20: 45220

**RESINS**
- curing stresses in epoxy, 20: 43906 (ORNL-P-2361)
- ion exchange separation of iodine fractions, 20: 43029
- use of epoxy, for cementing isolation rings in neutron generator accelerator tubes, 20: 44059

**RETICULO-ENDOTHELIAL SYSTEM**
- pathological manifestations of leukemic reticulosis of, 20: 42729

**RHENIUM**
- effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
- effects on hydrogen absorption by niobium and tantalum in presence of thermal gradient, 20: 43832 (NASA-TN-D-3546)
- properties as thermionic emitter, 20: 44168
- separation from other elements by ion exchange using triisoöctylamine, 20: 43439
- strength at high temperatures, effects of alloying on, 20: 43969

**RHENIUM ALLOY COUPLES**
- Mo/Mo–Re, calibration of thermocouples of, pressure effects on, 20: 43636 (UCRL-14993)

**RHENIUM ALLOYS**
Bi–Re, superconductivity, 20: 44554
Cr–Re, atomic ordering in sigma phase, 20: 43890 (COO-1198-385)
Fe–Re, atomic ordering in sigma phase, 20: 43890 (COO-1198-385)
Mo–Re, superconducting transition temperature of 90Mo–10Re, pressure effects on, 20: 44568
Nb–Re, hydrogen absorption in, 20: 43832 (NASA-TN-D-3546)
Re–Ta, hydrogen absorption in, 20: 43832 (NASA-TN-D-3546)
Re–Tc, transition temperature of superconducting, effects of composition on, (E), 20: 44559
Re–W, machining procedures for, 20: 43864 (Y-1550)
**RHENIUM ISOTOPES Re-186**
nuclear data sheets, 20: 44713
**RHENIUM ISOTOPES Re-187**
nuclear data sheets, 20: 44714
**RHENIUM ISOTOPES Re-188**
nuclear data sheets, 20: 44715
**RHENIUM ISOTOPES Re-189**
nuclear data sheets, 20: 44716
**RHODIUM**
separation from uranium fission products by precipitation as potassium hexanitrorhodate(III), 20: 44815
**RHODIUM ALLOYS**
Pd–Rh, diffusion of deuterium and hydrogen in, 20: 43934
**RHODIUM COMPLEXES**
bromopentammine, radiation effects on, from chemical reactions of recoil atoms, neutron, 20: 43340
**RHODIUM ISOTOPES Rh-103**
neutron capture by, production of isomeric rhodium-104 in thermal, (E), 20: 44689
neutron capture by, rhodium-104 energy-level transitions from thermal, (E), 20: 44690
**RHODIUM ISOTOPES Rh-104**
conversion electron spectrum, (E), 20: 44848
energy-level transitions from thermal-neutron capture by rhodium-103, (E), 20: 44690
production of isomeric, in thermal-neutron capture by rhodium-103, (E), 20: 44689
**RHODIUM ISOTOPES Rh-105**
yields from spontaneous fission of uranium-238, equilibrium-ratio calculations of, 20: 44815
**RHODIUM ISOTOPES Rh-106**
determination of, in presence of niobium-95 and zirconium-95, coincidence methods for, 20: 43158
half life, (E), 20: 44712
**RIBONUCLEASE**
effects on development of Ehrlich's ascitic carcinoma, 20: 42728
radiation effects on activity in liver, gamma, 20: 42796
reactions in rat liver, 20: 42702(R) (ANL-7136, pp 243-55)
reactions in yeast cells and spheroplasts, 20: 42702(R) (ANL-7136, pp 243-55)
spectra of deuterated imidazole group in, PMR, 20: 43281
spectra of deuterated imidazole group in histidine residues of, PMR, 20: 43281
**RIBONUCLEASE, DEOXY-**
effects on development of Ehrlich's ascitic carcinoma, 20: 42728
radiation effects on activity in liver, gamma, 20: 42796
**RIBONUCLEIC ACID**
effects of protein phytohemagglutinin on synthesis of, tracer study, 20: 43272(R) (RLO-581-10, pp 5-32)
inactivation of transfer, by horseradish peroxidase, 20: 42809
radiation effects on synthesis of, in *Paramecium caudatum*, uv, 20: 42800(T) (ORNL-tr-1289)
radiation effects on content in regenerating *Polycelis nigra*, x, 20: 42933
radiation effects on, in poliovirus, x, 20: 42966
radioinduced decomposition of *E. coli*, characterization of x, 20: 42814
radioprotective effects on leukopoiesis in rabbits and rats, 20: 42937
**RIBONUCLEIC ACID, DESOXY-**
acridine binding sites for, 20: 42841(R) (ANL-7136, pp 266-89)
effects of protein phytohemagglutinin on synthesis of, tracer study, 20: 43272(R) (RLO-581-10, pp 5-32)
histone separation from interphase chromatin, in x-irradiated rat thymocytes and subsequent effects on nuclear structure, 20: 42989
lethality induction correlated with induction of photoreversible non-dark repairable damage to synthesis of, 20: 42812
origin in cytoplasmic organelles, 20: 42701(R) (ANL-7136, pp 205-30)
photoreversal of dark repairable blockage of synthesis in *E. coli*, 20: 42812
properties of circular species of, formed after lysogenic induction of *E. coli* K12 $\lambda$, 20: 42721
radiation effects on activity in liver, gamma, 20: 42796
radiation effects on synthesis of, in *Paramecium caudatum*, uv, 20: 42800(T) (ORNL-tr-1289)
radiation effects on synthesis in rat thyroids of, $\beta$, 20: 42857(R) (TID-23228)
radioinduced inactivation of transforming, in the presence of inhibitors, gamma, 20: 42818
radioinduced inhibition of thymidine incorporation into, x, 20: 42777
radioinduced lesions in *E. coli*, role in uv mutation mechanisms, 20: 42918
radioprotective effects on leukopoiesis in rabbits and rats, 20: 42937
replication model for, 20: 42838(R) (ANL-7136, pp 140-54)
replication of chromosomal, 20: 45243 (UCRL-14625(Rev.1))
role of single master strand of, in genetic coding in *E. coli*, 20: 42838(R) (ANL-7136, pp 140-54)
species specificity of reannealed, in animals, 20: 42757
structure of, single-strand breaks in duplex of coliphage T7, 20: 42715(R) (UCRL-16246, pp 145-55)
synthesis in *Escherichia coli*, relation to genetic recombination, 20: 42838(R) (ANL-7136, pp 140-54)
synthesis in rat mammary epithelium, relation to x-ray induced carcinogenesis, 20: 42840(R) (ANL-7136, pp 164-90)
thermal stability of animal, 20: 42757
**RICE**
radiation effects on growth of, following sulfur-35 irradiation of seeds, varietal differences in, 20: 42949
**RICININE**
nitrogen-15 labeling positions in, mass spectral studies on, 20: 43382
**ROCKET REACTORS**
design of tungsten-based, uranium-oxide fueled, beryllium moderated, 20: 45199
fuel separation from propellant in gaseous-core, (T), 20: 45201
**ROCKET REACTORS (KIWI)**
contamination of environment by, following Kiwi-TNT, 20: 43576 (CONF-660621-7)
design of modular, for lunar support and deep-space missions, 20: 45200
**ROCKETS**
flight effect on electron density of ionospheric F region, (E), 20: 44459
**ROCKS**
age of igneous, estimation of, 20: 43502(R) (COO-689-60, App.A-2)
age of igneous, estimation of, 20: 43506(R) (COO-689-60, App.A-6)
age of metamorphic, estimation of, 20: 43501(R) (COO-689-60, App.A-1)
analysis by bremsstrahlung activation methods, 20: 43119
analysis for antimony, activation, 20: 43080 (ORO-2670-15)
analysis for elements using 2-Mev charged particles, 20: 43097
calcium-to-strontium ratio in, effects of morphological form on, 20: 43534
correlation and chronology of volcanic, research program on, 20: 43500(R) (COO-689-60)
lead isotope contents in volcanic magmas, 20: 43521
neutron background in, 20: 43547
neutron production in, factors affecting, 20: 43547
oil-water interface in, use of neutron scattering in determining, 20: 43553
**RODENTS**
care of wild, in laboratories, 20: 42833(R) (ANL-7136, pp 16-46)
radiation dose to, in Minas Gerais, Brazil, 20: 43606
radiation effects on hibernating ground squirrels, $\gamma$ and x, 20: 42834(R) (ANL-7136, pp 46-63)
radiation effects on, lethal $\alpha$, $\beta$, $\gamma$, and x, 20: 42934
radiosensitivity of, effects of species on $\gamma$, 20: 42833(R) (ANL-7136, pp 16-46)
role in plague infections in United States, 20: 43588 (RM-5090-TAB)
role in transfer of *Pasteurella pestis* in plague epidemics, 20: 43587 (RM-4968-TAB)
**ROOTS**
effects of space flight on chromosome aberrations in, of higher plants, 20: 42909
radiation effects on initiation of Coleus, leaf exposure to $\gamma$, 20: 42842(R) (ANL-7136, pp 290-301)
radiation effects on diurnal variations in mitotic frequency in Pinus, gamma, 20: 42953
**ROSE BENGAL**
analysis of iodine-131-labeled, for impurities, 20: 43386
labeling with iodine-131, by ion exchange, 20: 43386
labeling with iodine-131, 20: 43397
radiation dose to gastrointestinal tract from ingested iodine-131-labeled, 20: 43043
**ROTORS**
speed and temperature of ultracentrifuge, measurement by radiotelemetry, 20: 43637(R) (UCRL-16246, pp 168-75)
**RUBIDIUM**
determination in silicate rocks by neutron activation methods, 20: 43133
distribution in human blood, 20: 42778
separation from cesium by ion exchange, 20: 43133
**RUBIDIUM BROMIDES**
proton channeling in, 20: 45016
**RUBIDIUM COMPOUNDS**

with molybdenum and tungsten bronzes, preparation, properties, and structure of, 20: 43213
**RUBIDIUM IONS**
reactions of monovalent, with dinonylnaphthalenesulfonic acid, effects of diluent on, 20: 43447
**RUBIDIUM ISOTOPES**
use in geological dating, method and equipment for, 20: 43500(R) (COO-689-60)
use in geological dating, method for, 20: 43501(R) (COO-689-60, App.A-1)
use in geological dating, method for, 20: 43502(R) (COO-689-60, App.A-2)
use in geological dating, method for, 20: 43503(R) (COO-689-60, App. A-3)
**RUBIDIUM ISOTOPES Rb-84**
gamma spectra, 20: 44634(R) (IDO-17188)
**RUBIDIUM ISOTOPES Rb-86**
determination in neutron-irradiated clays and soils, 20: 43607
uptake and distribution in heart tissues of dogs, mechanisms involved in coronary circulation, 20: 42749
**RUBIDIUM TUNGSTOCERATES**
preparation and physicochemical properties, 20: 43253
**RUBIDIUM URANYL NITRATES**
radiation effects on fluorescence spectra of, neutron, 20: 43365
**RUMANIA**
radioisotope production and uses in, 20: 43769
**RUPTURE**
theory of crystal, method of developing, 20: 43910(R) (TID-23269)
**RUSSIAN REACTORS**
design and economics of BN-350, 20: 45159
**RUTHENIUM**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in seawater, activation, 20: 43086(R) (TID-23295, Sect.3)
determination in urine, oxidation method for, 20: 43129
**RUTHENIUM ALLOYS**
Bi–Ru, superconductivity, 20: 44554
Ru–U, combustion kinetics of, 20: 43612
**RUTHENIUM ISOTOPES**
fixation by muds, 20: 43544
**RUTHENIUM ISOTOPES Ru-100**
meson $(\pi)$ and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
**RUTHENIUM ISOTOPES Ru-101**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**RUTHENIUM ISOTOPES Ru-102**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**RUTHENIUM ISOTOPES Ru-103**
content in nuclear debris over Sweden, 1962 to 1963, 20: 43524
fractionation in fallout from Chinese and Russian tests, 20: 43528
separation from irradiated uranium oxides using molten sodium chloride, 20: 43454
**RUTHENIUM ISOTOPES Ru-104**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**RUTHENIUM ISOTOPES Ru-106**
content in Clinch River from ORNL waste solutions, 20: 45223
content in river water in Germany, 1961 to 1966, 20: 45225
determination in urine, oxidation and beta-counting method for, 20: 43129
determination of, in presence of niobium-95 and zirconium-95, coincidence methods for, 20: 43158
distribution in water and silt of British estuaries, 20: 45224
half life on vegetation, effective, 20: 45219
release to atmosphere from NRTS, 20: 45219
separation from Clinch River sediments, 20: 45216 (ORNL-3721)
separation from irradiated uranium oxides using molten sodium chloride, 20: 43454
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**RYE**
strontium-90 content in domestic and imported, in Finland, 1963 and 1964, 20: 43006

**S**

**SACCHARIC ACID**
reactions with dysprosium, 20: 43140
**SACLAY PROTON SYNCHROTRON**
beam control for Saturn, design and performance of system for, 20: 44048
**SAFETY**
in handling plutonium alloys and compounds, 20: 43578 (HW-59541)
plutonium oxidation using steam in inert atmospheres, 20: 43854 (HW-66431)
radioisotope handling, in Canada, 20: 43763
**SAFETY HAZARDS**
airborne plutonium contamination in production areas, 20: 43595
of radioactive contamination of surface waters to animals and plants, 20: 43598
public health evaluation of, from operation of nuclear power plants, 20: 43632
**SAINT LAURENT-DES-EAUX REACTOR (EDF-4)**
containment for, design and construction of prestressed concrete, 20: 45127(T) (ORNL-tr-1228)
**SALICYLATE COMPLEXES**
with antipyrine and rare earths, benzene solvent extraction studies on, 20: 43256
**SALICYLIC ACID**
use for therapy of beryllium disease in animals, 20: 42754
**SALICYLIC ACID, SULFO-**
use for therapy of beryllium disease in animals, 20: 42754
**SALIVARY GLANDS**
radiation injuries to, in experimental animals following subcutaneous injection of radionuclides, 20: 42967
radioactivity contained in, of experimental animals following subcutaneous injection of radionuclides, 20: 42967
**SALT DEPOSITS**
waste disposal in, laboratory studies of, 20: 45217 (ORNL-P-2126)
**SALTS**
determination in solution using pulsed neutrons, 20: 43163(P)
tracer study of balance of, with water in human body, 20: 42782
**SAMARIUM**
content in Gulf of Mexico surface water, 20: 43087(R) (TID-23295, Sect.4)
ionization potentials of, electron-impact method for measuring, 20: 43235
magnetic properties at 2 to 300°K, 20: 43939
separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)
**SAMARIUM ALLOYS**
Al–Sm, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Sm, crystal structure of intermetallic compound, 20: 43920
**SAMARIUM CHLORIDES**
properties of, magnetic and thermal, 20: 43176 (NP-16302)
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
**SAMARIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with antipyrine-salicylates, benzene solvent extraction studies on, 20: 43256
with glycolic and lactic acids, thermodynamic properties of, 20: 43215
**SAMARIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218
**SAMARIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
fluorescence of trivalent, in sodium tungstate solution, 20: 43211
fluorescence of trivalent, in potassium oxalate solution, 20: 43212
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
**SAMARIUM ISOTOPES**
energy levels of, rotational, (T), 20: 44843
**SAMARIUM ISOTOPES Sm-143**
gamma spectra, 20: 44634(R) (IDO-17188)
**SAMARIUM ISOTOPES Sm-144**
separation from neutron-deficient europium-144, 20: 43067(R) (IDO-14679, pp 6-46)
**SAMARIUM ISOTOPES Sm-145**
energy levels from beta decay of europium-145, (E), 20: 44845
**SAMARIUM ISOTOPES Sm-147**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**SAMARIUM ISOTOPES Sm-149**
energy levels of, determination from europium- and promethium-149 decay, 20: 45046(R) (IDO-17192)
neutron cross section uncertainty, 20: 45193 (CONF-660303, pp 204-9)
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**SAMARIUM ISOTOPES Sm-151**
determination in waste solutions by isotope dilution mass spectrometry, 20: 43068(R) (IDO-14679, pp 47-50)
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**SAMARIUM ISOTOPES Sm-152**
alpha reactions $(\alpha,2n)$ at 18 to 20.5 Mev, gadolinium-154 energy-level transitions from, (E), 20: 44735
energy levels of, octupole vibrational, (T), 20: 44825
energy-level transitions from neodymium-150 $(\alpha,2n)$ reactions at 18 to

20.5 Mev, (E), 20: 44735
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**SAMARIUM ISOTOPES Sm-154**
alpha reactions ($\alpha$,2n) at 18 to 20.5 Mev, gadolinium-156 energy-level transitions from, (E), 20: 44735
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)
**SAMARIUM ISOTOPES Sm-155**
decay of, europium-155 energy-level transitions from, (E), 20: 44736
**SAMARIUM NITRIDES**
magnetic properties at 2 to 300°K, 20: 43939
**SAMARIUM OXIDES**
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
**SAMARIUM PERRHENATES**
preparation and properties of, 20: 43217
**SAMARIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219
**SAMARSKITES**
analysis of, for niobium and tantalum by column extraction, 20: 43131
**SAMPLING**
equipment and method for continuous surface water, 20: 43523
for radioactivity in liquid scintillation medium, 20: 43748(P)
indexing of radioactive samples for, 20: 43748(P)
method for radionuclide, at NRTS, 20: 45219
methods for air, during reactor fuel manufacture, 20: 43630
methods of continuous, of surface water, 20: 43624
statistical method for obtaining optimum allocation of total sample size, 20: 42698(R) (ANL-7136, pp 80-94)
**SANDS**
movement in rivers, use of chromium-51 tracer to study, 20: 43549 (NP-16200)
radioactivity of, used in Roorkee University buildings, India, 20: 43533
use for filtration of research reactor feed solutions, 20: 43426 (ORNL-TM-1650)
**SAP (SINTERED ALUMINUM PRODUCTS)**
corrosion by terphenyl at 400°C, fretting, 20: 43843
fabrication and testing capsules of, 20: 43812(R) (BNWL-269, pp 4.1-9)
reactions with urania at 450 to 600°C, 20: 43835 (RISO-91)
reactions with uranium monocarbide at 450 to 600°C, 20: 43835 (RISO-91)
wear in vibration against antimony tellurides, 20: 43843
**SAPPHIRES**
degassing of, 20: 43815(R) (NASA-CR-54356)
electric properties as capacitor material, 20: 43815(R) (NASA-CR-54356)
**SARCOMAS**
pathological manifestations of leukemic reticulo-, induced by chemotherapy or x rays, 20: 42729
radiation effects on growth of cells from, x, 20: 42888
radiation effects on transplants of mouse, x, 20: 42889
radiation effects on growth of Yoshida ascites, in rats, x, 20: 42962
radioinduced immunity to grafted J, in CBA mice, x, 20: 42890
**SAVANNAH RIVER COMPONENTS TEST REACTOR**
neutron flux distributions in, calculation of, 20: 45203 (DP-1045)
**SAVANNAH RIVER PLANT**
environs monitoring, January to June 1966, 20: 43577(R) (DPST-66-30-2)
**SAVANNAH RIVER PRODUCTION REACTORS**
control rod actuator system for, design of, 20: 45190 (DP-670)
**SAXTON POWER REACTOR**
performance of, reliability of, 20: 45181
**SCANDIUM**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in seawater by activation and gamma spectrometry, 20: 43059 (BNWL-SA-674)
determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
properties and uses of, review of, 20: 43203
separation from calcium by ion exchange, 20: 43430
separation from other rare earths by ion exchange using triisoöctylamine, 20: 43439
separation from pitchblende residues, leaching processes for, 20: 43420 (MCW-1508)
**SCANDIUM ALLOYS**
Al–Sc, properties of intermetallic compounds in, tabulation of, 20: 43972
**SCANDIUM COMPOUNDS**
preparation, properties, and uses of, review of, 20: 43203
**SCANDIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
**SCANDIUM ISOTOPES Sc-40**
mass from threshold energy for calcium-40 (p,n) reactions, (E), 20: 44812
**SCANDIUM ISOTOPES Sc-42**
energy levels from calcium-40 ($\alpha$,d) reactions at 24.8 Mev, (E), 20: 43717
**SCANDIUM ISOTOPES Sc-44**
beta decay of isomeric, calcium-44 energy levels from, (E), 20: 44682
**SCANDIUM ISOTOPES Sc-46**
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
determination in neutron-irradiated clays and soils, 20: 43607
gastrointestinal transit time of ceramic spheres containing, 20: 42740 (LA-DC-7764)
incorporation in tetrahydrated ammonium thallium sulfates, mixed crystal formation in, 20: 43252
**SCANDIUM ISOTOPES Sc-47**
energy levels of, from titanium ($\gamma$,p) reactions at 0.16 to 0.51 Mev, 20: 43102
**SCANDIUM ISOTOPES Sc-48**
decay scheme, 20: 43550(R) (NYO-844-67)
**SCANDIUM OXIDES**
reactions with hydrochloric acid, product formation in, 20: 43259
**SCATTERING**
amplitude of $g\,\phi^4$ lagrangian interaction, analytical properties of, 20: 44396
amplitude of, wave-packet derivation of field-theoretic, 20: 44318
amplitudes and cross sections for high-energy, equations for, 20: 44301
amplitudes for high-energy elastic, 20: 44384
amplitudes of elastic, at high energies, (T), 20: 44374
amplitudes of forward, Bethe-Salpeter equation for absorptive parts of, 20: 44310
amplitudes of, solutions of N/D equations for, 20: 44307
Feynman diagrams for, method for calculating, 20: 44294
Feynman diagrams in, complex singularities of, 20: 44343
Green's functions in, analytic expression for class of, 20: 44368
Landau curve of single-loop scattering diagram with internal diagonal line, 20: 44342
Levinson theorem in, generalization of, 20: 44293
phase shift analysis of spin-independent, 20: 44337
potential theory of, principle of maximum and minimum in, 20: 44300
potential, regularization method in, 20: 44330
potentials for, phase shifts in stochastic fields for, (T), 20: 44393
potentials in inverse, asymptotic properties of, 20: 44321
potentials in, nonuniqueness of N/D solutions for singular, 20: 44347
Regge poles at zero energy in, 20: 44344
S-matrix in, extraction of singularities from, 20: 44319
S-matrix in, gauges and invariance of, 20: 44303
S-matrix in, Jost functions, Levinson theorem, and multichannel problems in relativistic, 20: 44386
S-matrix theory of, normal thresholds in subenergy variables in, 20: 44305
S-matrix theory of, icecream-cone singularity, 20: 44306
S-matrix theory of, spin and statistics in, 20: 44332
theory of many-body potential, review of, 20: 44654 (PUC-937-227)
theory of multichannel potential, long-range perturbations in, (T), 20: 44802
theory of multichannel, four-fermion and Yukawa coupling equivalence for, 20: 44377
theory of, completeness of set of eigenstates of non-Hermitian operators in, 20: 44707
**SCHISTOSOMA**
immune reactions of mice to irradiated cercariae of, 20: 42947
**SCHWARTZWALDER MINE (COLO.)**
radon decay product inhalation hazards in, 20: 43617
**SCINTILLATION DETECTORS**
calibration of sodium iodide, measurements on distributed gamma sources, 20: 43668(R) (ANL-7136, pp 1-16)
design and performance for aerial survey of gamma activity, 20: 43513 (CEX-59.4.26)
design for alpha particles, 20: 43750
design for negative halogen ions, 20: 43735
design for neutrons, 20: 43750
design of x-ray, for 1–12 Å range, 20: 43726
development of balloon-borne, for fallout monitoring in upper atmosphere, 20: 43512(R) (ANL-7136, pp 315-27)
efficiency of liquid, methods for determining, 20: 43675
efficiency of liquid, for separation of beta spectra of carbon-14 and tritium, 20: 43098
electron ionization loss at 20 to 150 Mev in Ne 102A, 20: 44232
fabrication of high pressure helium-3 gas, for gammas and neutrons, 20: 43733
liquid, control circuits for, 20: 43749(P)
performance of, evaluation standards for, 20: 42738(R) (ANL-7136, pp 255-65)
photomultiplier design and performance for use with, 20: 43746
pulses from cosmic ray, design and sensitivity of system for measuring amplitude of, 20: 43687

sample handling and indexing for, 20: 43748(P)
use for whole-body counting of calcium-47 and strontium-85 in bone metabolism studies, 20: 42744(R) (UCRL-16246, pp 19-35)
use in bone density gamma radiography, 20: 43049
use in neutron dosimetry, 20: 43671 (ORNL-P-2467)
uses and instrumentation for, review of, 20: 43096
**SCREENS**
iodine retention on silver-plated copper, 20: 43067(R) (IDO-14679, pp 6-46)
**SEA WATER**
analysis for cesium-137 and trace elements by activation and gamma spectrometry, 20: 43059 (BNWL-SA-674)
analysis for copper, manganese, and zinc, activation, 20: 43085(R) (TID-23295, Sect.2)
analysis for rare earth elements by cation exchange, 20: 43087(R) (TID-23295, Sect.4)
analysis for ruthenium, activation, 20: 43086(R) (TID-23295, Sect.3)
analysis for yttrium-90, method for, 20: 43688
analysis for zirconium and zirconium-95, spectrophotometric, 20: 43088(R) (TID-23295, Sect.5)
calcium-to-strontium ratio in, effects of morphological form on, 20: 43534
corrosive effects on steel in evaporator environments, review, 20: 43834 (ORNL-TM-1612)
desalination for Northeast U. S. water supplies, potential, 20: 45186 (NP-16148)
desalination of, cost of nuclear and fossil fuel plants for, 20: 45187
desalination of, economic and technical advantages of dual-purpose nuclear power plants in Israel, 20: 45188
desalination of, using nuclear energy, California Water Plan, for, 20: 43195
diffusion of soluble contaminants in, 20: 43541
effects of movement on climate, 20: 43505(R) (COO-689-60, App.A-5)
isotopic variations of deuterium and oxygen-18 in, 20: 43509
oxygen-18 enrichment of, effect of evaporation on, 20: 43509
radioactive contamination of organisms inhabiting, 20: 43596
radioactive contamination of, Japan, 1961–64, 20: 43615
radioactive decay of strontium-85-labeled strontium titanate in, 20: 43592 (USNRDL-TR-1042)
strontium-90 content in, estimate of total, 20: 43517(T) (AEC-tr-6798, Paper 2)
strontium-90 distribution on surfaces of ocean, 20: 43516(T) (AEC-tr-6798, Paper 1)
**SEAFOOD**
food poisoning incidents attributed to, 20: 43775
radiation effects on microbial populations on fillets of yellow perch, following refrigerated storage, gamma, 20: 43793
radiopreservation of, using gamma radiation, 20: 43774
radiopreservation of fresh, pickled, salted, smoked, and cooked, effects on taste and storage life, gamma, 20: 43776
**SEALING MATERIALS**
radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
**SEALS AND GLANDS**
design for inspection window on pressure vessels, 20: 45062
development of ceramic-metal bore, for use with alkali metals, 20: 43815(R) (NASA-CR-54356)
radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
**SEBACIC ACID, ESTER POLYMERS**
radiation effects on physicochemical properties of, 20: 43343
**SEED**
genetic effects of space flight on pine and wheat, 20: 42912
radiation effects on maize, fast-neutron and x, 20: 42843 (BNL-10358)
radiation effects on cotton, gamma, 20: 42896
radiation effects on, of pure and hybrid winter wheat, gamma, 20: 42897
radiation effects on cabbage, high energy protons, 20: 42898
radiation effects on mutagenesis in dry *Vicia faba*, 20: 42920
radiation effects on rice growth following sulfur-35 irradiation of, varietal differences in, 20: 42949
radioinduced chromosome breaks in *Vicia faba*, effects of dinitrophenol on, 20: 42913
radioinduced mutations in wheat, x, 20: 42846 (IAEA-2466-13)
radiosensitivity of Pinus, $\gamma$, 20: 42850(R) (NYO-2043-130)
sulfur metabolism in cacao, 20: 42850(R) (NYO-2043-130)
**SEEDLINGS**
effects of light on metabolism in squash, 20: 42842(R) (ANL-7136, pp 290-301)
radiation effects on density and diversity of, in tropical rain forest, $\gamma$, 20: 42853(R) (ORO-3299-1)
radiation effects on height of barley, grown at low and high altitudes, 20: 42894
radiation effects on diurnal variations in mitotic frequency in root tips of Pinus, gamma, 20: 42953
radiation effects on, protective effects of inert gases and low molecular narcotics on x, 20: 43007
**SEISMIC WAVES**
detection and recording of, from Salmon Event, 20: 43551 (VUF-3015)
**SEISMOLOGY**
instrumentation for up-hole-velocity surveys, 20: 43551 (VUF-3015)
**SELENIOUS ACID**
analytical use in qualitative analysis of tetravalent and trivalent cerium mixtures, 20: 43122
**SELENIUM**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in solution, colorimetric, 20: 43071 (IDO-14679, pp 75-191)
determination on polystyrene filters, colorimetric, 20: 43069(R) (IDO-14679, pp 51-9)
separation from pitchblende residues, leaching processes for, 20: 43420 (MCW-1508)
**SELENIUM ISOTOPES Se-75**
use of compounds labeled with, in medicine, 20: 43051
**SELENIUM ISOTOPES Se-79**
gamma spectra, 20: 44634(R) (IDO-17188)
**SELENIUM ISOTOPES Se-82**
neutron reactions $(n,\gamma)$ with, isomer ratios from, 20: 44816
**SELF-DIFFUSION**
activation in alpha-uranium, thermodynamics of, 20: 43928
**SEMICONDUCTOR DETECTORS**
barrier layer depth in n-i-p silicon, 20: 43742
charge collection time of lithium-compensated silicon, 20: 43703
charge collection efficiency of silicon surface-barrier, 20: 43705
design and performance of lithium-drifted silicon, for charged particle identification, 20: 43717
design and performance of surface-barrier silicon, for charged particle identification, 20: 43717
development of lithium-6 fluoride-sandwiched silicon, for neutron spectrometry, 20: 43718
preparation of silicon p-i-n, (E), 20: 43741
response characteristics of germanium and silicon, to gamma rays, Monte Carlo calculation of, 20: 43701
use in nuclear research, 20: 43737
use of silicon diode, for neutron diffraction analysis, 20: 43730
use of, in LET measurements and neutron dosimetry, 20: 43671 (ORNL-P-2467)
**SEMICONDUCTORS**
electromagnetic wave propagation in, nonlinear theory of, 20: 44966
electromagnetic, plasma, and spin wave interactions in antiferromagnetic, coupling of, 20: 43982
photocurrent noise spectra in, design of analyzer for l-f, 20: 43653
**SENA POWER REACTOR**
development, 1–3/66, 20: 45124(R) (TID-23339)
development, 10–12/65, 20: 45123(R) (TID-23338)
**SEPARATION PROCESSES**
criticality control in, for zirconium fuel, effects of boric acid on, 20: 43067(R) (IDO-14679, pp 6-46)
economics of aqueous, pyrochemical, and volatility, for carbide, metal, and oxide fast-breeder reactor fuels, 20: 43410 (ANL-7137)
isotopic fractionation during analytical, 20: 42738(R) (ANL-7136, pp 255-65)
**SERUMS**
content of $\beta$-glucuronidase of carcinoma patients during radium therapy, 20: 43025
radiation effects on properdin of human and bovine, uv, 20: 42823
**SEX**
analysis of, in patients undergoing fluoroscopy, 20: 43050
frequency of liver metastases from Yoshida ascites sarcoma in male and female rats, 20: 42962
radiation effects on *Ascaridia galli*, x, 20: 42968
**SF MATERIALS ACCOUNTING**
equipment and measurements for, of uranium compounds, 20: 43065 (GAT-T-1403)
sampling and weight control in, of uranium hexafluoride, 20: 43062 (CONF-661011-1)
**SHEEP**
cesium-137 retention in, 20: 42739(R) (COO-1339-3)
etiology and pathology of glomerulonephritis in, 20: 42855(R) (TID-23203)
potassium-40 content in tissues of, internal radiation dose from, 20: 42940
potassium-40 measurements in, for use as growth index, 20: 42739(R) (COO-1339-3)
recovery from radiation injury as evaluated by split-dose technique, 20: 42996
**SHELLS**
nozzles in pressurized spherical, stress at, 20: 43467 (TID-23343)
nozzles in spherical, flexibility of, 20: 43468 (TID-23344)

**SHELTERS**
design of, effect of apertures and ceiling-shine on, 20: 43526
evaluation of residential structure for protection against fallout radiation, 20: 43496 (CEX-59.7B(Pt.1))
shielding properties of roof slab and structures against fallout, calculation of, 20: 43568 (AD-636787)
**SHIELDED CONTAINERS**
design, 20: 43475(P)
design for shipment of radioactive materials, 20: 43492 (ORNL-TM-1312(Vol.2))
design for storage and shipping of radioactive materials, 20: 43476(P)
**SHIELDING**
bibliography on, Soviet-literature, 20: 43666 (AD-623557)
comparison of theory and experimentation of, from structures for radiation protection against fallout, 20: 43568 (AD-636787)
design of accelerator, skyshine calculations for, (E), 20: 44057
effects of, of abdomen of rats during x irradiation of Yoshida sarcoma, 20: 42962
gamma transport in compartmented, Monte Carlo computer code for, 20: 44987 (AD-637685)
optimization for SNAP manned vehicles, fast-neutron weighting factors, 20: 43580 (NAA-SR-Memo-11901)
protective effects of, in man against chronic low doses of radiation, 20: 42865
use of lead, for Paramecium growth studies, 20: 42886
use of lead, for protection of gonads during electron beam therapy, 20: 43012 (BMwF-FBK-66-03)
use of water, for personnel protection, 20: 43613
**SHIELDING MATERIALS**
efficiency of concrete, in criticality incident of $10^{17}$ fissions, 20: 43421 (NP-16216)
evaluation of refractory concretes, 20: 44005
gamma attenuation in, tables of equivalent thickness of, 20: 44989
radioactivity in cement raw materials, 20: 43514 (UCRL-16878)
**SHIPPING**
casks for radioactive materials, structural analysis of, 20: 43492 (ORNL-TM-1312(Vol.2))
materials management in, of uranium compounds, 20: 43065 (GAT-T-1403)
regulations for beryllium-containing materials, 20: 43629
sampling and weight control in, of uranium hexafluoride, 20: 43062 (CONF-661011-1)
**SHIPPINGPORT PRESSURIZED WATER REACTOR**
neutron flux wire measurements in core 2 seed 1, 20: 45125 (WAPD-PWR-TE-203)
performance of, reliability of, 20: 45181
**SHOCK TUBES**
curvature of shock wave in circular, (T), 20: 44890
helium ionization in, from uv radiation, 20: 44980
use in study of plasma dynamics, (T), 20: 44167
**SHOCK WAVES**
curvature of, in circular shock tubes, (T), 20: 44890
effects on photoviscoelastic plates, 20: 43495(R) (AD-628806)
electron and ion density ahead of air, 20: 44403(R) (AD-628143)
hazards of, to populations during nuclear wars, 20: 43566 (AD-625251)
interactions with impure argon, mass spectroscopy of, 20: 43123
production in interplanetary medium, by solar flares, (T), 20: 44098
structure of Alfvén, (T), 20: 44414
**SIALIC ACID**
biochemical reactions of rat erythrocyte, effects of bacterial α-amylase on, 20: 42714 (UCRL-16246, pp 119-25)
**SILANE**
radioinduced in phosphine and phosphine–silane, recoil silicon atom reactions in, 20: 43315
$PH_3$–$SiH_4$, radiation effects on di- and monosilane production in, recoil silicon atom reactions in neutron, 20: 43315
**SILICATE ROCKS**
analysis for cesium and rubidium by ion exchange and activation methods, 20: 43133
**SILICATES**
content in Mediterranean Sea, effects of season, temperature, and Nile River flooding on, 20: 43508(R) (NP-16179)
effect of, on reactor effluent radionuclides, 20: 45215 (BNWL-282)
radioactive waste fixation in poly-, 20: 45226
**SILICIDES**
deposition on niobium alloys as oxidation-resistant coatings, fluidized-bed process for, 20: 43881
**SILICON**
annealing of, kinetics of complex defect, 20: 43968
barrier layer depth in n-i-p detectors of, 20: 43742
charge collection time of detectors of lithium-compensated, 20: 43703
charge collection efficiency of surface-barrier detectors of, 20: 43705
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in presence of iron, use of lithium-drifted germanium detector for, 20: 43081 (ORO-2980-13)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
electron reactions with single crystals at 15 Mev, coherent bremsstrahlung radiation from, (E), 20: 45020
electron-hole pair production in lithium-compensated, temperature dependence of energy for, (E), 20: 45028
neutron cross sections from 0.037 ev to 18 Mev, tables of, 20: 44661 (UNC-5139)
neutron total cross section from 5.0 to 8.5 Mev, fluctuations in, (E), 20: 44743
preparation of p-i-n detectors of, by lithium ion drift, (E), 20: 43741
radiation effects on single crystals of, electron, 20: 44998
radiation effects on, channeling pattern formation in ion, 20: 45022
radiation effects on phosphorus-doped, fast neutron, 20: 43986 (AD-637937)
radioinduced damage in n- and p-type, electron, 20: 45018
radioinduced effects at energies below 300 kev in n-type, electron, 20: 45001
reactions of recoil, with gaseous phosphine and phosphine–silane mixtures, production of silanes by, 20: 43315
response to gamma rays, Monte Carlo calculation of characteristics of, 20: 43701
separation from reactor fuels by dissolution and sand filtration, 20: 43426 (ORNL-TM-1650)
use of diodes of, for neutron diffraction analysis, 20: 43730
**SILICON CARBIDES**
performance as graphite coating under irradiation, oxidation, and thermal cycling conditions, 20: 43825 (BNWL-242)
**SILICON ISOTOPES Si-27**
gamma spectra, 20: 44634(R) (IDO-17188)
**SILICON ISOTOPES Si-28**
description using Hartree-Fock approximation with density-dependent two-nucleon interaction, (T), 20: 44785
deuteron reactions (d,α) at 6.98 to 9.86 Mev, isospin selection rule in, (E), 20: 44841
proton reactions (p,γ) with, phosphorus-29 energy levels from, (E), 20: 44790
proton reactions (p,n) with, phosphorus-28 mass from threshold energy for, (E), 20: 44812
**SILICON OXIDES**
radiation effects on role of, in dealkylation of cumene, 20: 43319
radioinduced graft polymerization of styrene, vinylphosphonic acid dichloranhydride, and vinylpyridine on, 20: 43311
separation from reactor fuels by dissolution and sand filtration, 20: 43426 (ORNL-TM-1650)
**SILICON STEEL**
heat treatments at 900°C, austenizing effects on PM 24, 20: 43891 (EURAEC-1686)
**SILICON SYSTEMS**
Al–Si, properties of intermetallic compounds in, tabulation of, 20: 43972
Cr–Si–Ti, deposition and performance as oxidation-resistant coating for niobium alloys, 20: 43827 (GTR-19)
Si–Ag, performance as oxidation-resistant coating for niobium alloys, 20: 43827 (GTR-19)
**SILKWORMS**
effects of temperature on radioinduced sterility in male, 20: 42930
radiation effects on chromosomes in spermatocytes of, uv, 20: 42895
**SILTS**
analysis for antimony, activation, 20: 43080 (ORO-2670-15)
analysis of Clinch River, for radionuclide distribution, 20: 45223
fixation capacities, 20: 43544
monitoring of, design of gage for, 20: 43561
radioactivity in, continuous sampling for, 20: 43523
radioactivity of, from Clinch River system, 20: 45216 (ORNL-3721)
radioisotope transport by, 20: 43544
**SILVER**
activity coefficient of plutonium in liquid, estimated, 20: 43819
alpha particle energy loss and straggling in foils of, 20: 44144
deposition on thallium, effects of, on properties as beta source at 300 to 500°C, 20: 43400
desorption of iodide ions from, tracer studies of effects of electric fields, pressure, and temperature on, 20: 43250
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
diffusion of, in alpha- and beta-zirconium, tracer studies of, 20: 43974
electromagnetic wave propagation in, helicon, (E), 20: 44993 (NYO-2150-19)
electron reactions at 18 Mev, anomalous secondary electron emission

from, 20: 44117
electron scattering at 3.5 to 14.1 Mev on, backscattering from, (E), 20: 44115
electron scattering at 3.2 to 14.1 Mev, backscattering energy distributions from, (E), 20: 44116
electron-induced transition radiation and bremsstrahlung from foils of, grazing-incidence, 20: 44111 (ORNL-TM-1571)
molecular-beam scattering by single crystals of, spatial distributions in, (E), 20: 44121
neutron capture cross section discrepancies for, explanation by boron (n,α) cross sections in flux monitoring, 20: 44611 (CONF-660303, pp 486-501)
photoelectric and optical properties of films of, in extreme ultraviolet, (E), 20: 44995 (ORNL-TM-1392)
radiation effects on valence of, in glasses, gamma, (E), 20: 44012
radiation effects at cryotemperatures on, recovery rates of electron, 20: 44022
radioinduced diffusion of lead and silver in, alpha, (E/T), 20: 44002
radioinduced resistivity changes in thin layers of, silver ion, (E), 20: 44004
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
superconducting transition temperature of tin laminates with, 20: 44567
use as electrodes in ionization chamber for neutron flux monitoring, 20: 43680
use in G-M counters with activable cathodes, for measurement of fast neutron fluxes, 20: 43729

**SILVER ALLOYS**
Bi–Ag, superconductivity, 20: 44554
Pd–Ag, diffusion of deuterium and hydrogen in, 20: 43934
Pd–Ag, diffusion of deuterium and hydrogen in, effects of pressure and temperature on, 20: 43935

**SILVER IONS**
effects of irradiation by, on resistivity of thin silver layers, (E), 20: 44004
radioinduced reduction to atomic state in glasses, gamma, (E), 20: 44012

**SILVER ISOTOPES Ag-107**
energy level quantum numbers and transitions, (E), 20: 44782
hyperfine structure $^2D_{5/2}$ and $^4F_{9/2}$ states of, 20: 44141

**SILVER ISOTOPES Ag-109**
half life of isomeric, (E), 20: 44712
hyperfine structure $^2D_{5/2}$ and $^4F_{9/2}$ states of, 20: 44141

**SILVER ISOTOPES Ag-111**
use in radiotherapy, 20: 42796

**SILVER SYSTEMS**
Si–Ag, performance as oxidation-resistant coating for niobium alloys, 20: 43827 (GTR-19)

**SINGLE CRYSTALS**
diffusion of xenon from uranium nitride, tracer study of, 20: 43981
dislocation reactions and hardening in body-centered cubic, 20: 43923
neutron diffractometry of, equipment for high-pressure, 20: 43473(T)
optical properties of lithium niobate, 20: 43950
production methods for, 20: 43910(R) (TID-23269)

**SINTERING**
of oxides, studies, 20: 43813(R) (COO-1122-3)

**SKELETON**
radiation dose from strontium isotopes to human, 20: 43605
radiation effects on metabolism in epiphysis and metaphysis of rat, x, 20: 42785

**SKIN**
contamination of, by antimony-125, polonium-210, promethium-147, sulfur-35, thallium-204, effects of acidity of soiling solution on, 20: 43010
effects of radium-224 on diseases of, 20: 43046
induction of contact dermatitis, ulcers and granulomata from beryllium contact of, 20: 42752
radiation effects on carcinogenesis induced by dimethylbenzanthracene in mouse, beta and x, 20: 42969
radiation effects on guinea pig, protective effects of cysteamine against, 20: 42990
radiosensitivity of mouse, effects of cysteine and cysteamine on, 20: 42998(R) (EUR-2992.f)
radon-222 diffusion through rat, as affected by temperature and uv-irradiation, 20: 42790
ultrasonic decontamination of rat, contaminated with radioisotopes, 20: 42811

**SKIN LESIONS**
radiotherapy of metastatic, arising from internal neoplasms, 20: 43039

**SLUGS**
analysis for aluminum and thorium in aluminum-coated thorium, titritmetric, 20: 43071 (IDO-14679, pp 75-191)

**SLURRIES**
dehydration of radioactive, effects of polymers on, 20: 45218(T) (KFK-tr-201)

**SNOW**
water content in, use of natural radioactivity in determining, 20: 43559

**SODIUM**
analysis for oxygen, device for interference reduction and sensitivity improvement in activation, 20: 43075 (LA-DC-7931)
analysis of liquid, for carbon, 20: 43135
analysis of, for metallic and oxygen impurities by emission spectrography, 20: 43083 (R-66SD3012)
combustion in reactors, properties of, 20: 45047 (NAA-SR-12041)
corrosive effects on titanium–vanadium alloys at 550 to 750°C, 20: 45106(R) (ANL-7249)
corrosive effects of stainless steel 304, 20: 45106(R) (ANL-7249)
corrosive effects of liquid on steels in loops, statistical analysis of data on, 20: 43826 (GEAP-4830)
corrosive effects on vanadium-base alloys at 650°C, 20: 43809 (BNL-50003)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in aluminum and aluminum alloys by activation methods, 20: 43155
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
determination of, in carbazole by neutron activation methods, 20: 43116
diffusion through cellophane membrane, coefficients of, 20: 43239
effects of high-oxygen, on 304 stainless steel creep-rupture properties, 20: 43809 (BNL-50003)
effects on electron spin resonance of boronated graphite, (E), 20: 44008
effects on mechanical properties of steels at 1100°F, 20: 43897 (MSAR-66-174)
heat of vaporization and vapor pressure of, 20: 43884 (AGN-8191(Vol.1))
neutron total cross section from 5.0 to 8.5 Mev, fluctuations in, (E), 20: 44743
purification and handling of, for use in corrosion loop, 20: 43083 (R-66SD3012)
reactions of gaseous, with rare earth chlorides, thermodynamics of, 20: 43222
separation from irradiated magnesium, methods for, 20: 43550(R) (NYO-844-67)
specific volume at 1577 to 2491°F, (E), 20: 43946
thermodynamic properties at boiling point to 2550°F, (E), 20: 43944
thermodynamics of liquid, niobium loop for, 20: 43879
vapor pressures at 2540°F, saturation, (E), 20: 43945

**SODIUM ACID CARBONATES**
decontamination effects of, with ultrasonics on rat skin contaminated with $^{131}I$, $^{32}P$, or $^{90}Sr$, 20: 42811

**SODIUM BOROHYDRIDES**
use in synthesis of tritium-labeled digoxin, 20: 42722

**SODIUM CHLORIDES**
content in blood plasma of irradiated fish, effects of salinity of environment on, 20: 42885
content in Mediterranean Sea, effects of season, temperature, and Nile River flooding on, 20: 43508(R) (NP-16179)
radiation effects on microhardness and dislocation mobility of, x, (E), 20: 45005
radioinduced F centers in pure and calcium-doped, gamma, 20: 44996
use of molten, in separation of fission products from irradiated thorium and uranium oxides, 20: 43454
$KCl–MgCl_2–NaCl–UO_2Cl_2$, electrolysis of molten, at 500 to 600°C, 20: 43266(P)
$MgCl_2–KCl–NaCl$, exchange of plutonium in liquid systems with magnesium–zinc alloys, thermodynamics of, 20: 43819

**SODIUM CHROMATES**
analysis of, for trivalent chromium-51 using thin-layer chromatography and scintillation counting, 20: 43114

**SODIUM COMPOUNDS**
with molybdenum and tungsten bronzes, preparation, properties, and structure of, 20: 43213

**SODIUM CYANIDES**
radiation effects on, at 300°K, ESR studies of gamma, 20: 43350

**SODIUM FLUOALUMINATES**
$Na_3AlF_6–WO_3$, tungsten oxide single crystal growth in molten, 20: 43257

**SODIUM FLUORIDES**
color centers in irradiated, $F_2^+$, 20: 45029
radioinduced color centers in, zero-phonon lines of, electron and neutron, (E), 20: 45035
$CeF_3–NaF$, density and molar volume of, 43165 (BM-RI-6836)
KF–NaF, density and molar volume of, 20: 43165 (BM-RI-6836)
$LaF_3–NaF$, density and molar volume of, 43165 (BM-RI-6836)
LiF–NaF, density and molar volume of, 20: 43165 (BM-RI-6836)
$NaF–ThF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)

NaF–UF$_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
NaF–YF$_3$, density and molar volume of, 20: 43165 (BM-RI-6836)

**SODIUM GRAPHITE REACTORS**
fuel element irradiation testing for LSGR, 20: 45113 (NAA-SR-11440)

**SODIUM HYDROXIDES**
analysis for iodine in solutions of, colorimetric, 20: 43071 (IDO-14679, pp 75-191)
radiation effects on frozen aqueous solutions of, EPR spectra of gamma, 20: 43290 (COO-1528-7)

**SODIUM IODIDES**
resolution response of crystals of thallium-activated, for electrons, 20: 43704

**SODIUM IONS**
efflux from rat liver slices, relation to pyridine nucleotides, 20: 42758
efflux from rat liver slices, effects of potassium ion, glycosides, and antibiotics, 20: 42759
reactions of monovalent, with dinonylnaphthalenesulfonic acid, effects of diluent on, 20: 43447

**SODIUM ISOTOPES Na-22**
content in rain water, 1962-1964, 20: 43546

**SODIUM ISOTOPES Na-23**
energy levels of, low-lying J = ½, (T), 20: 44754

**SODIUM ISOTOPES Na-24**
content in rain water, 20: 43546
content in reactor effluent, effect of SiO$_2$ on, 20: 45215 (BNWL-282)
determination in neutron-irradiated clays and soils, 20: 43607
energy levels from magnesium-26 (p,He-3) reactions, isobaric analogue, (E), 20: 44758
gamma spectra, 20: 44634(R) (IDO-17188)
use in measurements of sodium ion efflux from rat liver slices, 20: 42758
use in studies of sodium ion efflux from rat liver slices, 20: 42759

**SODIUM NITRATES**
effects on preparation of iodine-131-labeled hippuran, 20: 43403
radiolysis of aqueous solutions of, ESR spectral studies on radicals in gamma, 20: 43310
radiolysis of, effects of methanol and nitrite radicals on yields from pulse, 20: 43321

**SODIUM NITRITES**
radiolysis of frozen aqueous solutions of, ESR spectral studies on, 20: 43309

**SODIUM OXIDES**
effects on ion-exchange properties of aluminum silicates, 20: 43449

**SODIUM PHOSPHATES**
use of, in paper electrophoresis of americium-241, cesium-134, curium-246, europium-152, promethium-147, and zirconium-95, 20: 43451
NaPO$_3$–WO$_3$, tungsten oxide single crystal growth in molten, 20: 43257

**SODIUM SILICATES**
effect of, on reactor effluent radionuclides, 20: 45215 (BNWL-282)

**SODIUM SULFATES**
benzene–didecylamine–Na$_2$SO$_4$–H$_2$SO$_4$–H$_2$O, solvent properties for uranyl sulfate, interface and transferring species in, 20: 43424 (ORNL-P-2359)

**SODIUM THIOSULFATES**
decontamination effects of, with ultrasonics on rat skin contaminated with $^{131}$I, $^{32}$P, or $^{90}$Sr, 20: 42811

**SODIUM TUNGSTATES**
fluorescence of lanthanide ions in, effects of pH, concentration, temperature, and time on, 20: 43210
fluorescence of trivalent lanthanide ions in, 20: 43211

**SODIUM TUNGSTOCERATES**
preparation and physicochemical properties, 20: 43253

**SODIUM URANYL ACETATES**
infrared absorption spectrum of monocrystalline, at room temperature, 20: 43285

**SODIUM ZIRCONIUM SILICATES**
preparation and properties of Na$_2$ZrSi$_2$O$_7$, 20: 43220

**SOIL MECHANICS**
use to determine soil behavior during projectile penetration, 20: 45240 (SC-RR-66-376)

**SOILS**
calcium-to-strontium ratio in, effects of morphological form on, 20: 43534
cesium-137 content in Chicago, Ill., 1965, 20: 43512(R) (ANL-7136, pp 315-27)
cesium-137 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
chemical properties of recent volcanic ash, 20: 42850(R) (NYO-2043-130)
density of, use of radioisotopes in determining, 20: 43762
diffusion of polonium-216 and radon-220 from surfaces of, 20: 43543
effects on fallout uptake by plants, 20: 43596
gamma spectra of neutron-irradiated, changes of, 20: 43607
moisture content determination in, cost comparison of neutron-moderation and gravimetric methods of, 20: 43094
moisture content of, neutron hygrometer for measurement of, 20: 43558
potassium, thorium, and uranium contents of, gamma spectrometric measurements of, 20: 43542
preparation of samples of, for environmental radiation surveillance, 20: 42733
projectile penetration in, 20: 45240 (SC-RR-66-376)
radioactive contamination in Japan, 1961–64, 20: 43615
radioactivity content of, from fallout in West Germany, 20: 43626
radioactivity induced in, neutron, 20: 43607
radium-226 uptake by vegetables and cereals from, 20: 42792
strontium-90 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
trafficability estimation by gamma spectroscopy, 20: 43542
use of radioisotopes in organic matter studies, 20: 42795

**SOL-GEL PROCESS**
for production of dense thoria, 20: 43850 (CONF-660524-15)
preparation of thoria–urania-233 fuel by, 20: 45094(R) (BAW-3460-2)

**SOLAR BATTERIES**
radioinduced damage in n- and p-type silicon, electron, 20: 45018

**SOLAR FLARES**
effects on cosmic-ray intensity, sudden commencements correlated with, 20: 44419
effects on directional distribution of cosmic mesons, 20: 44422
effects on geomagnetic sudden commencements, 20: 44466
Forbush decreases and questionable geomagnetic disturbances, 20: 44420
Forbush decreases, intensity recovery from, 20: 44421
gamma production in, analysis of, 20: 44093
ion content in, rare-gas, 20: 44104
model for high-energy phase of, 20: 44086
neutron flux following, search for solar, 20: 44452
occurrence of, association of sunspot magnetic fields, cosmic rays, and radio bursts with, 20: 44102
origin of, plasma cloud and shock wave effect on, 20: 44471
shock wave production in interplanetary medium by, (T), 20: 44098
x-ray enhancements during, correlated with microwave bursts, 20: 44101

**SOLAR RADIATION**
capture of ionic, using aluminum foils, 20: 44697
effects on coronal rotation, 20: 44073
emission of x-ray, correlated with microwave bursts during solar flares, 20: 44101
interaction of solar with lunar surface, 20: 44035
interactions of corpuscular, with geomagnetic field, (T), 20: 44439
interactions of solar wind with geomagnetic field, 20: 44460
neutron emission near solar minimum, search for, (E), 20: 44452
polar cap absorption by ionizing effect of, analysis by corrected geomagnetic coordinated, (E), 20: 44472
properties of positive-ion component of solar wind, (E), 20: 44078
properties of solar wind, and geomagnetic interactions, 20: 44069 (IPPJ-44(J))
trajectories of proton, in geomagnetic field, (T), 20: 44461

**SOLENOIDS**
properties of large-volume, highly uniform, at ORNL, 20: 44030 (ORNL-P-2492)

**SOLID SOLUTIONS**
radiation effects on rate-controlling mechanism for slip in body-centered-cubic, neutron, 20: 43998 (ORNL-3993)
radioinduced spin transfer in crystalline, (E), 20: 43317

**SOLIDS**
book: *Electron and Ion Processes in Solids*, 20: 43265
electron motion in, with randomly distributed impurities, (T), 20: 44393
properties at high temperatures, bibliography on, 20: 43903 (NP-16238)
radiation effects on phase transformation points in polymorphic, thermodynamic calculation of, 20: 45034

**SOLUBILITY**
effects of, on local tissue dose from strontium-90, 20: 43631

**SOLUTIONS**
analysis for acidity, titrimetric, 20: 43071 (IDO-14679, pp 75-191)
radiation chemistry of aqueous, structural model of hydrated electron in, 20: 43322

**SOUND**
propagation from chemical blasts, 20: 43461 (PNE-607F)

**SOVIET UNION**
radiation detection and protection in, bibliography on, 20: 43666 (AD-623557)

**SPACE**
plasma physics, 20: 44069 (IPPJ-44(J))
shock waves in interplanetary, production by solar flares, (T), 20: 44098
x-ray sources in, in direction of north galactic pole, 20: 44095

**SPACE FLIGHT**
effects of electrical, gravitational, and magnetic fields encountered during, on development and growth of plants, laboratory study on, 20: 42703(R) (ANL-7136, pp 302-14)
effects on chromosome aberrations in roots of higher plants, Vostok-5

and -6 results on, · 20: 42909
effects on mouse genetics, 20: 42986
effects on phage production, radiosensitivity, and viability of *Escherichia coli* cultures, · 20: 42912
genetic effects on seeds of pine and wheat, · 20: 42912
radiation effects on phage induction and viability in *E. coli* during, cosmic, · 20: 42910
radiation effects on phage induction and viability in $\beta$-mercaptopropylamine-treated *E. coli* during, cosmic, · 20: 42911
radiation protection during Voskhod I and Voskhod II, 20: 44990

**SPACE VEHICLES**
assembly of beryllium alloy components for methods of, · 20: 43859 (NASA-TM-X-53453(Vol.6))
components for, heat treatment methods for beryllium alloy, · 20: 43858 (NASA-TM-X-53453(Vol.5))
components of, cleaning and surface preparation for fabrication of beryllium alloy, · 20: 43857 (NASA-TM-X-53453(Vol.4))
components of, forming methods for beryllium alloy, · 20: 43856 (NASA-TM-X-53453(Vol.2))
hazards to biological systems from atmospheric reentry and burnup of nuclear rocket reactors and power supplies for, 20: 42740 (LA-DC-7764)
radiation protection for astronauts of Voskhod I and Voskhod II, 20: 44990
radiators for nuclear powerplants in, coatings for, 20: 43816(R) (PWA-2877)
reentry of Apollo-type, nonequilibrium ionization phenomena in plasma sheath from, (T), 20: 44861 (NASA-CR-596)

**SPAIN**
radioactivity of biological materials near Andujar uranium installation, 20: 43001

**SPALLATION**
effect of atmospheric gas, on radium content in rain water, 20: 43529
measurement of near-surface, in Salmon experiment, 20: 43462 (UCRL-13225)

**SPANISH REACTORS (DON)**
fuel handling machine for, power cell design for, 20: 45163
fuel handling system for, hook mechanism design and testing, 20: 45162

**SPARK CHAMBERS**
charged-particle scattering in, Molière theory for multiple, 20: 43744
description of frame-type and pen-box-type, with interelectrode gap of 1 cm, 20: 43724
design and performance for cosmic gamma radiation, 20: 43734
design with acoustic spark location, 20: 43725
foils for, stretching device for aluminum, 20: 43724
gases in, filling and purification system for, 20: 43724
particle track coordinates in, geometric reconstruction procedure for, 20: 43711
proton ionizing power in, measurement of, 20: 43691
x-ray production from discharges in, 20: 43714

**SPECTROMETERS**
development for sputtering yield measurements, 20: 43660
liquid scintillation, circuitry for automatic, 20: 43749(P)
stabilization system for scintillation and semiconductor, self-contained, 20: 43712
use of summing coincidence, and total absorption, for measuring gamma-emitting nuclides, 20: 43022

**SPECTROPHOTOMETERS**
use in determining ozone content of uv radiation rooms, 20: 43011

**SPECTROPHOTOMETRY**
atomic absorption methods of, for determination of trace elements in molybdenum and tungsten, 20: 43154
determination of residual activity of irradiated dehydrogenase, 20: 42816

**SPECTROSCOPY**
methods of, for semiquantitative simultaneous determination of 30 elements in powder samples, 20: 43104

**SPERM**
effects of temperature on irradiated silkworm, · 20: 42930
radiation effects on morphology and motility of bull, in suspensions, $\gamma$, 20: 42950
radiation effects on morphology and numbers in rats, x, 20: 42961

**SPERMATOGENESIS**
effects of temperature on irradiated germ cells during, in male silkworms, 20: 42930
effects of uv-irradiation during silkworm, on chromosomes, · 20: 42895
radiation effects on mouse, $\gamma$ and x, · 20: 42942
radiation effects on rat, x, 20: 42961

**SPHERES**
stresses analysis of steel, 20: 43491 (ORNL-P-2472)
use of ceramic, for studies of gastrointestinal transit of manganese-54 or uranium carbide particles, 20: 42740 (LA-DC-7764)

**SPINAL CORD**
radiation effects on innervation system on meninges of dog, · 20: 42881

**SPLEEN**
injuries to cell nuclei in mouse, from x rays in combination with acceleration or vibrations, 20: 42986
lymphoid regeneration in mouse, effects of thymus on, 20: 42984
radiation dose effects on weight and activity, 20: 42957
radiation effects on uptake of sulfur-35-labeled mycobacterial vaccine by microsomes and mitochondria in rat, x, · 20: 42907
radiation effects on cells of, in mice injected with 5-methoxytryptamine and cystamine, · 20: 42938
radiation effects on, in mice centrifuged prior to gamma or proton exposure, 20: 42985
radiation effects on rat, protective effects of barbamyl and serotonin on $\gamma$, 20: 43008
radioisotope scanning techniques for, 20: 43051

**SPORES**
radiosensitivity of *Clostridium botulinum*, type E, 20: 43775
radiosensitivity of fungi, effects of chemical radiosensitizers on $\gamma$, 20: 43784
repair of x-radioinduced chromosome aberrations in Tradescantia micro-, 20: 42977(R) (ORO-2669-2)

**SPUTTERING**
yields from, scanning spectrometer for, 20: 43660

**SQUIRRELS**
effects of nematade infection on central nervous system of ground, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on hibernating ground, effects of temperature on $\gamma$ and x, 20: 42835(R) (ANL-7136, pp 63-80)

**STACK DISPOSAL**
contamination from, at NRTS waste processing facility, 20: 45219
iodine-131 levels from, at BNL, 20: 43608
monitoring in beryllium production plants, 20: 43629
radiation monitoring at Bettis Lab., 1966, 20: 43586 (PNRO-DEV-136)

**STAINLESS STEEL**
analysis for carbon, titrimetric, 20: 43067(R) (IDO-14679, pp 6-46)
analysis for strontium, method for radiochemical, 20: 43069(R) (IDO-14679, pp 51-9)
analysis of coupons of, for fission products, 20: 43072(R) (IDO-14679, pp 193-229)
coating with actinides, target preparation by, 20: 43396
corrosion by flowing water at pH 5 and 100°C, dynamic, 20: 43833 (ORNL-TM-1030)
corrosion by sodium in loops of type 316, statistical analysis of data on, 20: 43826 (GEAP-4830)
corrosion of type 304, in air and sodium, · 20: 45106(R) (ANL-7249)
creep-rupture properties of 304, in 1200°F high-oxygen sodium, 20: 43809 (BNL-50003)
emissivity of titanate-coated, at high temperatures, 20: 43816(R) (PWA-2877)
hydrogen ion sputtering on, analysis of, 20: 44131
joining of type 316, to T-111 alloy, 20: 43830(R) (NASA-CR-72029)
mechanical properties of type 316, effects of air, helium, and sodium at 1100°F on, 20: 43897 (MSAR-66-174)
mechanical properties of austenitic, effects of thermomechanical treatments on, 20: 43916 (UCRL-16922)
puncture resistance of type 304L, effects of temperature on, 20: 43492 (ORNL-TM-1312(Vol.2))
radiation effects on type 304, neutron, · 20: 45106(R) (ANL-7249)
radiation effects on mechanical properties of type 304, 20: 43999 (ORNL-TM-1544)
radiation effects on ductility of 316, alpha and neutron, 20: 44015
radiation effects on formation of intergranular voids and cracks at 650 to 850°C in austenitic, thermal-neutron, 20: 44016
radiation effects on types 304 and 308, in-reactor, 20: 44027
use in G-M counters with activable cathodes, for measurement of fast neutron fluxes, 20: 43729
wear and corrosion testing as journal bearing material, 20: 43823 (AECL-2566)
wear effects on SAP in fretting corrosion, · 20: 43843
welding of cladding tape of, to steel, 20: 43852 (EURAEC-1685)
stainless steel–$UO_2$, extrusion of billets of, methods for, 20: 43848(R) (BNWL-269, pp 5.1-36)

**STANDARDS**
calibration of graphite-block, for thermal neutrons, 20: 45060
uranium contents of international, 20: 43563

**STARCHES**
radiation effects on alpha and beta amylases in corn and potato, gamma, 20: 42798 (NP-16224)
radiation effects on content in cotton pollen, gamma, · 20: 42896

**STARS**
collapse of, oscillatory motion of, 20: 44106
ejection of quasars from peculiar galaxies, ratio of blue-red shifts, 20: 44085

- energy from quasars, quark model for, 20: 44094
- evolution of helium, of intermediate mass, (T), 20: 44105
- evolutionary hydrogen-burning in, termination via beryllium-7-proton reactions, 20: 44076
- expansion of radio-emitting, relativistic control, (T), 20: 44083
- gamma absorption in quasars, high-energy, 20: 44084
- gravitational collapse of quasars, irreversibility of, 20: 44082
- identification of quasars, 20: 44090
- interactions in neutron, effects of strong, 20: 44074
- model of quasi-stellar radio sources, 20: 44087
- nucleosynthesis abundance calculations for, mass low dependence on, 20: 44070 (LA-DC-7885)
- origin of carbon, and second helium flash, 20: 44100
- photon emission from quasars, limits of, 20: 44947
- quasi-stellar radio sources identification, 20: 44088
- spectra from quasars, properties of, 20: 44072
- spectra shift from quasars, red, 20: 44103
- spectra shift of quasars, evolutionary aspects from, 20: 44092
- spectrophotometry of quasars, photoelectric, 20: 44071
- structure of, integration of equations for, 20: 44099

**STATISTICS**
- analysis of population mortality data, Monte Carlo, 20: 42698(R) (ANL-7136, pp 80-94)
- iterative process for sample analysis, 20: 42698(R) (ANL-7136, pp 80-94)
- machining procedures for, 20: 43864 (Y-1550)
- use in analysis of radiation injury recovery, 20: 42829 (AD-635167)

**STEAM**
- physical properties of, at high pressure and temperature, 20: 43173 (NAA-SR-Memo-12006)
- reactions with plutonium at 200 to 500°C, use in safe oxidation of scrap and skulls, 20: 43854 (HW-66431)
- steam–$H_2O$, heat transfer in circular pipes, 20: 43477 (CONF-661102-1)
- steam–water, pressure pulsations in heat transfer by, 20: 43478(R) (EURAEC-1620)
- steam–water, slip ratio of, at 212°F, 20: 43482 (ORNL-TM-1519)

**STEAM GENERATING HEAVY WATER MODERATED REACTOR**
- design and development, 20: 45173
- fuel cycle for, analysis of, 20: 45180

**STEAM POWER PLANTS**
- economics of fossil-fuel, of 300–1500 Mw, 20: 45242 (TID-22978(Rev.))

**STEARATES**
- stearate–stearic acid, labeling with calcium-45, barium-140, and lanthanum-140, 20: 43238
- stearate–stearic acid, reactions with barium, calcium, and lanthanum ions, effects of pH on, 20: 43238

**STEARIC ACID**
- stearate–stearic acid, labeling with calcium-45, barium-140, and lanthanum-140, 20: 43238
- stearate–stearic acid, reactions with barium, calcium, and lanthanum ions, effects of pH on, 20: 43238

**STEARIC ACID, METHYL ESTER**
- separation of labeled, tritium–carbon-14 isotope effects in chromatographic, 20: 43394

**STEEL**
- analysis for boron, carbon, nitrogen, and oxygen, x-ray spectrochemical method for, 20: 43161
- analysis for cobalt, effects of ions on gravimetric, 20: 43145
- analysis for oxygen, instrument for neutron activation methods of, 20: 43160
- analysis of high-alloy, for cerium, photometric, 20: 43143
- carbon deposition on, mechanism of, 20: 45114(R) (NP-16272)
- casting of, radiometric level control in continuous, 20: 43761
- cladding with stainless steel of heavy-gage, study of welding method for, 20: 43852 (EURAEC-1685)
- corrosion by sea water and water in evaporator environments, review, 20: 43834 (ORNL-TM-1612)
- ductility behavior of 4-inch plate of A302-B, Charpy-V notch, 20: 43997(R) (NRL-Memo-1663)
- gamma attenuation in, tables of equivalent thickness of, 20: 44989
- heat treatment of, effect of temperature variations on, 20: 43456(T) (ORNL-tr-1348)
- machining procedures for, 20: 43864 (Y-1550)
- puncture-resistance of hot-rolled type ASTM A245 grade A, effects of temperature on, 20: 43492 (ORNL-TM-1312(Vol.2))
- radiation effects on notch ductility of, neutron spectral effects in, 20: 43997(R) (NRL-Memo-1663)
- radiation embrittlement of A350-LF1, annealing effects on neutron, 20: 43997(R) (NRL-Memo-1663)
- radioinduced embrittlement, measurements using stress wave attenuation, 20: 43993(R) (EURAEC-1691)
- radioinduced embrittlement and recovery in ferritic, neutron, 20: 44019
- strain aging of conventional and ausform H-11, up to 900°F, 20: 43915 (UCRL-16761)
- wear and corrosion testing as journal bearing material, 20: 43823 (AECL-2566)
- welding of pressure-vessel, gas-arc, 20: 43851(R) (EURAEC-1671)

**STELLARATORS**
- plasma injection into L-1, 20: 44874(T) (MATT-Trans-36)

**STELLARATORS (C)**
- discharges in, temperatures of neutral atoms in, (E), 20: 44911

**STERILITY**
- effects of temperature on radioinduced, in male silkworms, 20: 42930
- radioinduced in Drosophila, relation of X-autosomal translocations to, 20: 42709(R) (TID-23233)

**STEROLS**
- metabolism in rat liver homogenates, tracer study, 20: 42737(R) (ANL-7136, pp 231-42)

**STILBENE**
- effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313

**STILBENES**
- isomerization of, in irradiated benzene, 20: 43360

**STOMACH**
- incidence of cancer of, among Japanese surviving atomic disasters, 20: 42697 (ABCC-18-65)
- radioinduced ulcers of, after $\gamma$ radiotherapy of lumbar lymph nodes, 20: 43019
- transit time of ceramic spheres containing manganese-54 or uranium carbide particles in, of animals and man, 20: 42740 (LA-DC-7764)

**STRATOSPHERE**
- charged-particle content in, (E), 20: 44463

**STRESS ANALYSIS**
- beta sources for use in, Kryptonate, 20: 43765
- of hollow circumferentially notched round bars, intensity factors for, 20: 43912 (UCRL-14859)
- of isothermally heated uranium, relaxation curves for, 20: 43936
- of salt columns in salt mines, 20: 45217 (ORNL-P-2126)
- of spherical pressure vessel with single radial nozzle, 20: 43491 (ORNL-P-2472)

**STRONTIUM**
- determination by charged-particle reactions at 2 Mev, 20: 43097
- determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
- determination in stainless steel, method for radiochemical, 20: 43069(R) (IDO-14679, pp 51-9)
- determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
- distribution in gypsum and anhydrite forms of calcium sulfate, from 0 to 80°C, tracer studies of, 20: 43534
- effects on radioinduced color centers in potassium chlorides, (E), 20: 45041(T)
- separation from barium, calcium, and cesium by ion exchange using heated Dowex column, 20: 43436
- separation from cesium by sorption by vermiculite, effects of EDTA and pH on, 20: 43130
- separation from yttrium by ion exchange, 20: 43430
- sorption by bismuth iodates, 20: 43448

**STRONTIUM CHLORIDES**
- sorption by glass, tracer studies of kinetics of, 20: 43251

**STRONTIUM COMPLEXES**
- with EDTA, effects on leaching of cesium from vermiculities, 20: 43130

**STRONTIUM IONS**
- effects on nitrate ion yields from radiolysis of potassium nitrate, 20: 43329

**STRONTIUM ISOTOPES**
- fixation by muds, 20: 43544
- use in geological dating, method and equipment for, 20: 43500(R) (COO-689-60)
- use in geological dating, method for, 20: 43501(R) (COO-689-60, App.A-1)
- use in geological dating, method for, 20: 43502(R) (COO-689-60, App.A-2)
- use of strontium-87/strontium-86 in geological dating, 20: 43503(R) (COO-689-60, App.A-3)

**STRONTIUM ISOTOPES Sr-85**
- decay of strontium titanate-incorporated, in marine environments, 20: 43592 (USNRDL-TR-1042)
- radiation effects on metabolism of, following pituitary irradiation, alpha, 20: 42744(R) (UCRL-16246, pp 19-35)
- retention in swine, 20: 42739(R) (COO-1339-3)
- tracer use of, for measuring long-term calcium metabolism in human bones, 20: 42764
- uptake by bones and human body following oral administration, 20: 42762

**STRONTIUM ISOTOPES Sr-89**
- dosimetry of, for human fetuses and infants, 20: 43605
- formulae for assessing body content of, following contamination in

adult human males, 20: 42779

**STRONTIUM ISOTOPES Sr-90**

content and diffusion in oceans, 20: 43541

content and distribution in Atlantic Ocean and adjoining seas, 1963-64, 20: 43540

content in air, soil, hay, milk and water in Switzerland, 1963, 20: 43519

content in Black Sea, 1960–1964, 20: 45227

content in Clinch River from ORNL waste solutions, 20: 45223

content in domestic and imported cereals and flour in Finland, 1963 and 1964, 20: 43006

content in Elbe River, 1961 to 1966, 20: 45225

content in human bones and tissues, 20: 43626

content in milk and milk powder produced in Japan, 1963–64, 20: 43610

content in milk in Bela Horizonte, Brazil, 20: 42999 (NP-15934)

content in milk in Japan, November 1962 to September 1963, 20: 43520

content in milk, rainwater, and soil in New Zealand, 1965, 20: 43581(R) (NP-16245)

content in oceans, 20: 43517(T) (AEC-tr-6798, Paper 2)

content in plants in East Germany from 1961 to 1963, 20: 43538

content in ratio with cesium-137 in human bones, Moscow, 1961 to 1964, 20: 42741 (NP-16265)

contents in meats in East Germany from 1961 to 1963, 20: 43538

correlation with lead-210 in human bones, 20: 42781

determination in bone ash, method for, 20: 43061 (CEA-R-2998)

determination in rainwater in New Zealand from 1956 to 1959, 20: 43530

determination in water and milk in Bombay, low-level beta counting method for, 20: 43532

distribution in different levels in Black Sea, 20: 43539

distribution on ocean surfaces, 20: 43516(T) (AEC-tr-6798, Paper 1)

dosimetry of, for human fetuses and infants, 20: 43605

effects of subcutaneously injected, on oral tissues of experimental animals, 20: 42967

formulae for assessing body content of, following contamination in adult human males, 20: 42779

intake in food, methods for estimating, 20: 43573 (CONF-765-13)

prediction of accumulation in bones in New York City, Poland, and Great Britain, 20: 43619

preparation of clean and carrier-free, 20: 43430

radiation dose from insoluble particles of, compared to that from soluble forms, 20: 43631

radiation dose to gastrointestinal tract from ingested, calculation of, 20: 43043

release to atmosphere from NRTS, 20: 45219

removal of, from rat skin by ultrasonics, 20: 42811

separation from Clinch River sediments, 20: 45216 (ORNL-3721)

separation from milk, methods for, 20: 43537

sorption from waste solutions by Yazoo and Zilpha clays, 20: 45221

sorption of by *Mytilus galloprovicialis*, 20: 42770

uptake and distribution in barley, oats, peas, and wheat, relation to calcium, 20: 42766

uptake and retention of by man in United Kingdom, equations for, 20: 42762

uptake of, by tissues of beagles on chronic ingestion regimen of the radionuclide, 20: 42780

**STRONTIUM ISOTOPES Sr-95**

effects on erythropoietic index and iron content in man, 20: 42908

**STRONTIUM TITANATES**

radioactivity release from strontium-85-labeled, in marine environments, 20: 43592 (USNRDL-TR-1042)

superconductivity in, 20: 44506

superconductivity in calcium- or barium-doped, 20: 44506

**STRUCTURAL ENGINEERING**

vibration of reactor components, solution of nonlinear, 20: 45061

**STRUCTURAL PANELS**

shielding properties of a roof slab against fallout, calculation of, 20: 43568 (AD-636787)

**STRUCTURES**

design of protective, solution of stress wave problems in, 20: 43495(R) (AD-628806)

radiological decontamination of, postattack requirements for, 20: 43567 (AD-635820)

shielding properties of, effect of aperture and ceiling-shine on, 20: 43526

shielding properties of, against fallout, calculation of, 20: 43568 (AD-636787)

**STRYCHNINE**

effects on acceleration tolerance in mice and guinea pigs, 20: 43004

**STYRENE**

radioinduced graft polymerization on cotton fabric, gamma, 20: 43299

radioinduced graft polymerization on fiber glass, silica gel, and zirconium oxide, preparation of ion exchange material by, 20: 43311

radioinduced graft polymerization on vinyl chloride polymers, gamma, 20: 43372

radioinduced polymerization on cellulose, 20: 43294

radioinduced polymerization at −78°C, effects of solvents on gamma, 20: 43308

radioinduced polymerization of, effects of ammonia, DPPH, nickel oxide, water, and zinc oxide on gamma, 20: 43338

radioinduced polymerization with α-methylstyrene, effects of ammonia and diethyl ether on, 20: 43338

radioinduced polymerization with isobutyl vinyl ether, effects of ammonia on diethyl ether on, 20: 43338

radioinduced polymerization of, in methylene chloride and toluene solution, effects of moisture and temperature on, 20: 43339

radioinduced polymerization on cotton, 20: 43349

**STYRENE, α-METHYL-**

radioinduced polymerization with styrene, effects of ammonia and diethyl ether on, 20: 43338

**STYRENE POLYMERS**

analysis of filters of, for selenium, colorimetric, 20: 43069(R) (IDO-14679, pp 51-9)

radiation effects on surface electrification of, gamma, 20: 43337

radiation effects on solutions of, effects of pyrene on, 20: 43355

thermal stability of filters of fibrous, at 105 and 145°C, 20: 43067(R) (IDO-14679, pp 6-46)

acrylonitrile–polystyrene, radiation effects on polymers of, 20: 43355

**SUBMARINES**

propulsion of, using cobalt-60 heat source, 20: 43797 (AGN-8163(Vol.3))

**SUCCINIC ACID**

effects on sodium ion efflux from rat liver slices, 20: 42758

**SUCCINIC OXIDASE**

ultraviolet radiation effects on activity of, in *Mycobacterium phlei*, 20: 42810

**SUCROSE**

separation from other sugars in photosynthetic chamber by paper chromatography, 20: 43402

**SUGARS**

radiation effects on content of blood, x, 20: 42917

radiation effects on content of, in potatoes, 20: 43773

separation of carbon-14-labeled, in photosynthetic chamber by paper chromatography, 20: 43402

**SULFATE COMPLEXES**

plutonium, stability constants for, 20: 43244

**SULFATE IONS**

effects on isotopic exchange between iodide and iodate ions, 20: 43248

effects on nitrate ion yields from radiolysis of potassium nitrate, 20: 43329

**SULFONATES**

localization of cobalt phthalocyanine tetrasulfonate in mouse tumors, 20: 42840(R) (ANL-7136, pp 164-90)

**SULFOXIDES**

dipentyl-, solvent properties for thorium, 20: 43444

dipentyl sulfoxides–TBP, solvent properties for thorium, 20: 43444

**SULFUR**

determination by charged-particle reactions at 2 Mev, 20: 43097

determination of, in carbazole by neutron activation methods, 20: 43116

metabolism by photosynthetic bacteria, 20: 42850(R) (NYO-2043-130)

metabolism in cacao seeds, 20: 42850(R) (NYO-2043-130)

neutron total cross section from 5.0 to 8.5 Mev, fluctuations in, (E), 20: 44743

**SULFUR COMPOUNDS**

radioinduced production in meats, 20: 42973

**SULFUR IONS**

charged distribution of 10- to 70-Mev stripped, 20: 44136

**SULFUR ISOTOPES**

metabolism in normal and irradiated mouse embryos, 20: 42765

**SULFUR ISOTOPES S-30**

beta decay, 20: 44733

**SULFUR ISOTOPES S-32**

effects on carbon sulfide ultraviolet emission spectra, 20: 43209

energy-level transitions from phosphorus-31 $(p,\gamma)$ reactions at 0.8 to 1.16 Mev, (E), 20: 44822

proton reactions $(p,n)$ with, chlorine-32 mass from threshold energy for, (E), 20: 44812

**SULFUR ISOTOPES S-34**

effects on carbon sulfide ultraviolet emission spectra, 20: 43209

proton reactions $(p,\gamma)$ with, chlorine-35 energy-level quantum numbers and transitions from, (E), 20: 44808

**SULFUR ISOTOPES S-35**

contamination of pig skin by, effect of acidity of soiling solution on, 20: 43010

content in seawater, 20: 43688

determination in biological materials by liquid scintillation counting, combustion methods for, 20: 43128

production of carrier-free, 20: 43398

radiation effects on uptake of vaccine-incorporated, by microsomes and mitochondria in rat spleen, x, 20: 42907

**SULFURIC ACID**

effects on electron spin resonance of boronated graphite, (E), 20: 44008
radiation effects on frozen aqueous solutions of, EPR spectra of gamma, 20: 43290 (COO-1528-7)
solvent properties for iron meteorites, 20: 43550(R) (NYO-844-67)
benzene-$H_2SO_4$–trioctylamine–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
benzene–didecylamine–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
benzene–didecylamine–$Na_2SO_4$–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, interface and transferring species in, 20: 43424 (ORNL-P-2359)

**SUN**

corona rotation of, effects on, 20: 44073
eclipse of, high-altitude aircraft photographs of, 20: 44417 (LA-DC-7837)
eclipse of, ionospheric absorption of radio waves during, 20: 44426
eclipse of, ionospheric absorption of radio waves during, 20: 44427
spot activity effect on cosmic-ray nucleon component, 20: 44425

**SUPERCONDUCTIVITY**

calorimetric study of, in alpha uranium, 20: 44504 (UCRL-17026)
detection by changes in inductance and losses of a resonant bridge, 20: 44508
electron tunneling in, boundary condition for Josephson, (T), 20: 44575
ferromagnetic spin correlation effects on, 20: 44549
Josephson frequency-voltage relation, experimental test of, 20: 44540
model for, new Fermi-surface, 20: 44542
symmetries in, dynamical rearrangement of, 20: 44518

**SUPERCONDUCTORS**

acoustic wave dispersion in, transverse, 20: 44536
critical current in high-field, field dependence of, 20: 44520
critical current in indium–thallium, effects of field orientation on, 20: 44560
critical field and surface current measurements for titanium–vanadium, 20: 44535
critical field measurements in solenoids, 20: 44508
critical field measurements for niobium–zirconium, resistive effects on surface, 20: 44534
critical fields of thin-film, (T), 20: 44574
critical magnetic field of thin superposed films of, 20: 44543
critical temperature of, with paramagnetic admixtures, (T), 20: 44513
critical temperature and critical field for pure gallium single crystals, 20: 44545
currents between, in high magnetic fields, 20: 44531
currents in foils, maximum of surface sheath, (T), 20: 44558
differential paramagnetic effect and harmonic generation in enclosed, 20: 44544
electric properties of tunnel junctions in lead, 20: 44533
electric resistivity and properties of pure and cadmium-doped tin, anisotropic, 20: 44546
electron tunneling in, quantum coherence in, 20: 44551
electron tunneling in, theory for, 20: 44570
electron tunneling in, electrodynamics of Josephson, 20: 44571
electron tunneling in, transverse magnetic field effects on, 20: 44572
electron tunneling in, properties of, 20: 44573
electron tunneling density of states in type-II, energy and purity dependence of, 20: 44525
excitations in, Goldstone theory for, 20: 45042
lattice effects on transition temperature in thallium, 20: 44566
magnetic field enhancement in tubes of, 20: 44532
magnetic field variations in, NMR spectra of, 20: 44517(T)
magnetic fields in shorted coils of, method for reversing, 20: 44564
magnetic flux retention in hysteretic, 20: 44521
magnetization of niobium, peak effect in, 20: 44528
model for organic polymer as, evaluation of Little, 20: 44541
pressure contacts with normal metals, effects of, 20: 44526
properties of eutectic alloy, effects of structure on, (E), 20: 44514
properties of vanadium, Ginzburg-Landau parameters for, 20: 44537
properties of, double coil pulse device for studying, 20: 44512
rotation of, magnetic field production from, 20: 44519
surface nucleation in magnetic-film-coated type II, 20: 44524
surface sheath in type-II, removal by copper plating, (E), 20: 44530
thermogalvanomagnetic effects in mixed state of type II, 20: 44538
transition temperatures of lead-alloy, 20: 44515
transition temperatures of, crystallite size effects on, 20: 44552
transition temperature of rhenium–technetium alloys, (E), 20: 44559
transition temperature of, effects of paramagnetic impurities on, 20: 44550
transition temperature of layers of silver and tin superimposed films, 20: 44567
transitions in barium–strontium titanates and calcium–strontium titanates, 20: 44506
transitions in strontium titanates, 20: 44506
transitions in type-II, nature of 50-cps phase, 20: 44522
tunneling in superimposed, and normal films, 20: 44565
ultrasonic wave attenuation in niobium, 20: 44529
use in power cables and transformers, niobium, aluminum, and beryllium, 20: 44562
use of magnet coils of, in NMR spectrometers, 20: 43685
use of thin film, for coupling ferromagnetic materials, 20: 45021

**SUPERFLUIDITY**

dissipation and critical velocities in helium-II, 20: 44503 (LA-DC-8165)
excitations in, Goldstone theory for, 20: 45042
flow of helium II, stability between rotating cylinders, 20: 44555
rotation of helium II, quantization of, (T), 20: 44563

**SURFACE WATERS**

beta activity in, comparison of methods for measurement of, 20: 43601
ecology of, factors affecting cesium-137 uptake by fish, 20: 43512(R) (ANL-7136, pp 315-27)
isotopic composition of, from Tarnobrzeg basin, 20: 43531
maximum permissible limits for beryllium in, 20: 42755
monitoring of, methods of sampling for continuous, 20: 43624
radiation monitoring of, at Savannah River Plant, January to June 1966, 20: 43577(R) (DPST-66-30-2)
radioactive contamination of organisms inhabiting, 20: 43596
radioactive contamination of, used for agricultural purposes, 20: 43598
radioactive contamination of, Japan, 1961–64, 20: 43615
radioactivity in, continuous sampling for, 20: 43523
radioactivity in, effect of mud and suspended matter on, 20: 43544
sand movement in, use of chromium-51 tracer to study, 20: 43549 (NP-16200)
waste disposal in, factors affecting, 20: 45224
zooplankton sampling in Ligurian Sea, 20: 42734

**SURFACES**

cleaning beryllium alloy, for bonding and plating, 20: 43857 (NASA-TM-X-53453(Vol.4))
cleaning methods for, 20: 43599
decontamination using ultrasonics and cleaning solutions, 20: 43623
radiation effects on molybdenum oxide, (E), 20: 44026(T)

**SURGERY**

effects on lymphatic dynamics, 20: 42976
efficiency of oophorectomy, for castration in human females, 20: 43044
of malignant tumors of testis, advantages and limitations, 20: 43034
use of radiotherapy following orchiectomy, 20: 43038

**SWEDEN**

cesium-137 levels in people and reindeer in, 20: 42736

**SWEDISH REACTORS (R-2)**

coolant beta monitor for, 20: 43688

**SWIMMING POOL REACTORS**

cobalt-60 irradiation facility in, 20: 43791

**SWINE**

contamination of skin of, by antimony-125, polonium-210, promethium-147, sulfur-35, thallium-204, effects of acidity of soiling solution on, 20: 43010
potassium-40 measurements in, for use as growth index, 20: 42739(R) (COO-1339-3)
recovery from radiation injury as evaluated by split-dose technique, 20: 42996
strontium-85 retention in, 20: 42739(R) (COO-1339-3)

**SWITZERLAND**

fallout monitoring, 1963, 20: 43519

**SYNCHROTRONS**

beam separators for proton, high-voltage performance of, 20: 44045(T) (NP-tr-1419)

**SYSTEMS FOR NUCLEAR AUXILIARY POWER**

insulation development for radioisotope, vacuum-foil thermal, 20: 43798(R) (ALO-3634-2)
reactivity calculations for, effects of uncertainties in zirconium cross sections on, 20: 45192 (CONF-660303, pp 88-90)
reactivity control using prepoisons, effects of cross-section uncertainties, 20: 45193 (CONF-660303, pp 204-9)
reactor control and stability analysis for, computer program for, 20: 45196 (NAA-SR-Memo-11894)
shield optimization for manned, fast-neutron weighting factors for, 20: 43580 (NAA-SR-Memo-11901)
shield weight scaling factors for reactors, 20: 45197 (NAA-SR-Memo-11971)

**SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-8)**

energy converter design for, computer program for calculating, 20: 45195 (NAA-SR-Memo-11819)
radiation effects on electric components for, 20: 45194 (NAA-SR-11924)

**SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-10)**

energy converter design for, computer program for calculating, 20: 45195 (NAA-SR-Memo-11819)
reactivity control of 10A using prepoisons, effects of cross-section uncertainties on, 20: 45193 (CONF-660303, pp 204-9)

temperature drift in reactivity in 10A, computer program for, 20: 45198 (NAA-SR-Memo-11977)
**ZILARD-CHALMERS REACTIONS**
effects of, in solid xenon compounds, 20: 43373

## T

**ANTALUM**
analysis of, for iron by atomic absorption spectrophotometry, 20: 43162
coatings of, compatibility with alumina at high temperatures, 20: 43927
compatibility with hydrogen in presence of thermal gradient, 20: 43832 (NASA-TN-D-3546)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in columbites and samarskites, 20: 43131
diffusion of nuclear reaction recoil products in, measurements of, 20: 43073 (JINR-P-2804)
dislocation structure of deformed single crystals of, 20: 43923
effects on coatability of niobium, 20: 43827 (GTR-19)
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
effects on properties of tungsten powder, 20: 43899 (NASA-TN-D-3610)
fabrication methods for, 20: 43425 (ORNL-P-2406)
machining procedures for, 20: 43864 (Y-1550)
preparation from niobium by solvent extraction using TBP, 20: 43437
separation from niobium by column extraction using TBP in kerosene, tracer studies of, 20: 43131
separation from niobium by paper chromatography using amines, 20: 43446
separation of, from niobium by reaction of the mixed pentachlorides with calcium fluoride and calcium oxide, 20: 43170 (IS-T-107)
strain aging, effect of stress on, 20: 43965
strain-aging in, (E/T), 20: 43922
testing as container material for liquid plutonium–cobalt–cerium alloy fuel, 20: 43814 (LA-DC-7581)
use of foils of, for corrosion protection of niobium–zirconium alloys, 20: 43837 (TIM-823)
welding of tubular, by magnetic force method, 20: 43848(R) (BNWL-269, pp 5.1-36)
work function of polycrystalline, 20: 43811(R) (BNWL-269, pp 1.1-28)
**ANTALUM ALLOYS**
coatings for, problems of protective, 20: 43877
compatibility with hydrogen in presence of thermal gradient, 20: 43832 (NASA-TN-D-3546)
Be–Ta, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Co–Ta, decomposition and structure of supersaturated, 20: 43938
Hf–Ta, corrosion in oxidizing atmospheres at high temperature, 20: 43842
Hf–Ta–W, fabrication and properties of T-111 for corrosion loops, 20: 43830(R) (NASA-CR-72029)
Hf–Ta–W, fabrication of T-111 tubes for corrosion loops, 20: 43831(R) (NASA-CR-72057)
Hf–Ta–W, joining of T-111 to type 316 stainless steel, 20: 43830(R) (NASA-CR-72029)
Hf–Ta–W, welding of T-111 to niobium–zirconium alloy, 20: 43830(R) (NASA-CR-72029)
Mo–Ta, thermal expansion of, 20: 43964
Nb–Ta, atomic structure of solid solutions of, x-ray-scattering study of, (E), 20: 43975(T)
Nb–Ta, electron tunneling in superconducting point contacts of, infrared frequency response of, (E), 20: 44548
Re–Ta, hydrogen absorption in, 20: 43832 (NASA-TN-D-3546)
Ta–Ti, crystal structure of titanium-base, effects of quenching and tempering on, 20: 43979
Ta–U, combustion kinetics of, 20: 43612
Ta–W, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
Ta–W, machining procedures for, 20: 43864 (Y-1550)
Ta–W, testing as container material for liquid plutonium–cobalt–cerium alloy fuel, 20: 43814 (LA-DC-7581)
Ta–W–Y, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
**ANTALUM CARBIDES**
preparation and properties of 100–1000 A particles of, 20: 43951
**ANTALUM ISOTOPES Ta-181**
gamma angular correlations from, testing P invariance in, (T), 20: 44806
gyromagnetic ratios ,(E/T), 20: 44791
neutron capture cross sections for, effects of (n,γn′) reaction on, (T), 20: 44614 (CONF-660303, pp 613-22)
neutron capture cross section discrepancies for, explanation by boron (n,α) cross sections in flux monitoring, 20: 44611 (CONF-660303, pp 486-501)
proton reactions (p,n) at 8 to 14 Mev, neutron spectra from, (E), 20: 44739
**ANTALUM ISOTOPES Ta-182**
neutron transmission through, (E), 20: 44604 (CONF-660303, pp 67-74)
**TANTALUM ISOTOPES Ta-186**
nuclear data sheets, 20: 44713
**TANTALUM NITRIDES**
preparation and properties of 100–1000 A particles of, 20: 43951
**TANTALUM OXIDES**
deformation on tantalum, mechanisms of anodic film, 20: 43949
separation from niobite–tantalite ore by solvent extraction using TBP, 20: 43437
**TANTALUM SYSTEMS**
O–Ta–W, crystal structure of $Ta_{16}W_{18}O_{94}$ in, 20: 43188
Ta–$ThO_2$, measurement of insulation heat loss of, 20: 43798(R) (ALO-3634-2)
Ta–$Y_2O_3$, measurement of insulation heat loss of, 20: 43798(R) (ALO-3634-2)
**TASTE**
radiation effects on fish, gamma, 20: 43770
radiation effects on potato, gamma, 20: 43773
**TAURINE**
formation during electron irradiation of primitive Earth atmosphere, tracer studies of, 20: 42726
**TECHNETIUM**
separation from molybdenum by solvent extraction using acetophenone and cyclohexanone, 20: 44817
**TECHNETIUM ALLOYS**
Re–Tc, transition temperature of superconducting, effects of composition on, (E), 20: 44559
**TECHNETIUM ISOTOPES Tc-93**
gamma spectra, 20: 44634(R) (IDO-17188)
**TECHNETIUM ISOTOPES Tc-94**
gamma spectra, 20: 44634(R) (IDO-17188)
**TECHNETIUM ISOTOPES Tc-96**
gamma spectra, 20: 44634(R) (IDO-17188)
separation of neutron-deficient, from molybdenum-97, 20: 43067(R) (IDO-14679, pp 6-46)
**TECHNETIUM ISOTOPES Tc-99**
deposition of albumin-incorporated, following inhalation in man, 20: 42797
incorporation in human serum albumin for scintillation scanning of lungs, 20: 43390
use of compounds labeled with, in medicine, 20: 43051
**TECHNETIUM ISOTOPES Tc-101**
decay schemes for, 20: 44817
**TECHNOLOGY**
radiosensitivity and dosimetry studies on living organisms, 20: 43625
**TEETH**
radiation injuries to, in experimental animals following subcutaneous injection of radionuclides, 20: 42967
radioactivity contained in, of experimental animals following subcutaneous injection, 20: 42967
**TEKTITES**
analysis for antimony, activation, 20: 43080 (ORO-2670-15)
oxygen-16/-18 ratio of Ivory Coast, 20: 43511
**TELEVISION EQUIPMENT**
design and performance for use in caves, chemical processing plants, and reactors, 20: 43472
**TELLURIC ACID**
neutron reaction with tellurium-130 in, preparation of iodine-131 by, 20: 43404
**TELLURIUM**
content in chondritic meteorites, 20: 44077
preparation and properties of, review on, 20: 43164 (ANL-7142)
separation from fission products, method for, 20: 43067(R) (IDO-14679, pp 6-46)
separation from uranium fission products, 20: 44815
**TELLURIUM FLUORIDES**
preparation and properties of, review on, 20: 43164 (ANL-7142)
**TELLURIUM ISOTOPES Te-130**
neutron reactions with, in telluric acid to produce iodine-131, 20: 43404
**TELLURIUM ISOTOPES Te-132**
content in nuclear debris over Sweden, 1962 to 1963, 20: 43524
yields from spontaneous fission of uranium-238, equilibrium-ratio calculations of, 20: 44815
**TELLURIUM OXIDES**
preparation and properties of, review on, 20: 43164 (ANL-7142)
**TELLURIUM OXYFLUORIDES**
preparation and properties of, review on, 20: 43164 (ANL-7142)
**TELLURIUM SYSTEMS**
Bi–Te, superconductivity, 20: 44554
**TEMPERATURE**
control and measurement of high, bibliography on, 20: 43903 (NP-16238)
effects of cryogenic, on engineering materials in combination with radiation and vacuum, 20: 43994(R) (FZK-290)

effects of hyperthermia on radiosensitivity of rats, 20: 42959
effects of hypothermia on radiosensitivity of mice and rats, 20: 42998(R) (EUR-2992.f)
effects of incubation, on γ-irradiated lysosomes isolated from rabbit polymorphonuclear leukocytes, 20: 42975
effects of, on radioinduced sterility in male silkworms, 20: 42930
effects on calcium release from irradiated plant tissues, 20: 42815
effects on flow and stability of rock salt, 20: 45217 (ORNL-P-2126)
effects on radioinduced color centers in cesium bromides, 20: 45036
effects on species specificity of animal DNA's, 20: 42757
measurement of ultracentrifuge rotor, by radiotelemetry, 20: 43637(R) (UCRL-16246, pp 168-75)
radiosensitivity effects on ground squirrels, 20: 42835(R) (ANL-7136, pp 63-80)
use of heat for control of pests infesting stored fruits and vegetables, 20: 43780

TENNESSEE RIVER SYSTEM
waste disposal in, radioactivity from, 1962 to 1963, 20: 45216 (ORNL-3721)

TENSILE PROPERTIES
effect of temperature variations in heat treatment on steel, 20: 43456(T) (ORNL-tr-1348)

TERBIUM
crystal structure at 120 to 300°K, 20: 45043
determination in rare earth oxides using antipyrine-salicylate complexes, fluorometric, 20: 43256
spectra in gadolinium trichloride, magnetic effects on, 20: 43177 (NP-16303)

TERBIUM ALLOYS
Al–Tb, crystal structure of intermetallic compound, 20: 43926
Al–Tb, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Tb, crystal structure of intermetallic compound, 20: 43920
Mn–Tb, crystal structure of intermetallic compound, 20: 43918

TERBIUM CHLORIDES
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

TERBIUM COMPLEXES
with antipyrine-salicylates, benzene solvent extraction studies on, 20: 43256
with glycolic and lactic acids, thermodynamic properties of, 20: 43215

TERBIUM IONS
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
fluorescence of trivalent, in sodium tungstate solution, 20: 43211
fluorescence of trivalent, in potassium oxalate solution, 20: 43212
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221

TERBIUM ISOTOPES Tb-154
gamma spectra, 20: 44634(R) (IDO-17188)

TERBIUM ISOTOPES Tb-155
gamma spectra, 20: 44634(R) (IDO-17188)

TERBIUM ISOTOPES Tb-159
gyromagnetic ratios, (E/T), 20: 44791

TERBIUM ISOTOPES Tb-160
gamma spectra, 20: 44634(R) (IDO-17188)
incorporation in tetrahydrated ammonium cerium sulfates, mixed crystal formation in, 20: 43252

TERBIUM PERRHENATES
preparation and properties of, 20: 43217

TERBIUM SULFATES
crystal structure of, infrared spectral studies on, 20: 43219

TERBIUM SYSTEMS
graphite–Tb, preparation and properties of intercalation compounds in, 20: 44999

TEREPHTHALIC ACID, ETHYLENE POLYMER ESTERS
radiation effects on, ESR of free radicals from gamma, 20: 43324
radiation effects on, gamma and electron, 20: 43378

TERPHENYL
corrosive effects on SAP, under fretting conditions, 20: 43843
heat transfer by ortho, in subcooled nucleate boiling, 20: 43486
thermal conductivity of, device for measuring, 20: 43270 (AEET-245)

TEXTILES
radioinduced graft polymerization of styrene on cotton, 20: 43299

THALLIUM
deposition on copper foil, beta source preparation by, 20: 43400
determination in iron meteorites by slow-neutron activation, 20: 43550(R) (NYO-844-67)
machining procedures for, 20: 43864 (Y-1550)
superconductivity of, lattice effects on, 20: 44566

THALLIUM ALLOYS
In–Tl, superconducting critical current in, effects of field orientation on, 20: 44560
Pb–Tl, superconducting transition temperatures of, 20: 44515

THALLIUM IONS
effects on nitrate ion yields from radiolysis of potassium nitrate, 20: 43329

THALLIUM ISOTOPES Tl-204
coating with cadmium, gold, and silver, effects on properties as beta source of, 20: 43400
contamination of pig skin by, effect of acidity of soiling solution on, 20: 43010
content in seawater, 20: 43688
distribution from nuclear explosion in salt deposit, 20: 43802

THERAPY
use of Mexaform S in radioinduced diarrhea, 20: 42994

THERMAL CONDUCTIVITY
equipment for measuring, of organic coolants, 20: 43270 (AEET-245)
measurement of liquid and solid, use of liquid-potassium heat pipe for, 20: 43179(R) (NYO-2082-6)

THERMAL CYCLING
effects on silicon carbide-coated graphite at 250 to 1200°C, 20: 43825 (BNWL-242)

THERMAL INSULATION
development vacuum-foil, for radioisotope power systems, 20: 43798(R) (ALO-3634-2)
radiation effects on, in combination with cryotemperatures and vacuum, 20: 43994(R) (FZK-290)
use of plastics in nuclear, 20: 43471

THERMAL RADIATION
effects on biological systems from nuclear explosions, 20: 42710 (TID-23348)
hazards of, to populations during nuclear wars, 20: 43566 (AD-625251)

THERMAL REACTORS
fuel performance for, plutonium-240 and uranium-238 effects on natural uranium, 20: 45103 (AECL-2590)

THERMAL STRESSES
effects on pipe and nozzle design, 20: 43468 (TID-23344)

THERMIONIC CELLS
design for operation in ball-of-fire mode, 20: 44170(P)
development, 20: 44169
development of, review of, 20: 45184
electric power production in, 20: 44168
electrodes for 1600–2200°K, nickel and rhenium, 20: 44168
modes for, comparison of ignited and surface-ionization, 20: 44168

THERMOCOUPLES
calibration of molybdenum/molybdenum–rhenium, pressure effects on, 20: 43636 (UCRL-14993)
performance of tungsten/tungsten–26% rhenium, in BORAX-V measurements, 20: 45209

THERMODYNAMICS
of high-temperature refractory systems, 20: 43913 (UCRL-16256)
relativistic properties of, 20: 44036

THERMOELECTRIC CELLS
design for space uses, computer program for calculating, 20: 45195 (NAA-SR-Memo-11819)
development, 20: 44169

THERMOLUMINESCENCE
radioinduced in magnesium-doped lithium fluoride, effects of pre-irradiation annealing on, (E), 20: 45008
use in age determinations for geological samples, 20: 43552

THERMOLUMINESCENT DETECTORS
performance of lithium fluoride, for gamma dosimetry, 20: 43747
use in neutron dosimetry, 20: 43671 (ORNL-P-2467)

THERMOMETERS
response to rapid temperature rise, method for determining, 20: 43635 (UCRL-12484(Rev.2))

THERMONUCLEAR EXPLOSIONS
hazards to populations from, 20: 43566 (AD-625251)
iodine isotope release from, effects on radioactivity in food chain and in man, 20: 43574 (CONF-660538-1)

THERMONUCLEAR REACTORS
accelerator for Astron, alignment system for, 20: 44866 (UCRL-70025)
book: *Magnetohydrodynamic Stability and Thermonuclear Containment*, 20: 44986
design of Alice, baseball coil and plasma-trapping chamber of, 20: 4486 (UCRL-70026)
design of Astron, 20: 44868 (UCRL-70027)
plasma stability in Tokomak, effect of transverse currents on, 20: 4485 (IAE-1152)

THICKNESS GAGES
catalog of Russian radiometric, 20: 43639(T) (AEC-tr-6633)
design of radiometric, for metal laminated strips, 20: 43642

THIOLS
radiation effects on content in yeasts, ionizing, 20: 42901

THIOPHENE
radiolysis of, EPR studies of radicals from electron, 20: 43330

**THIOPHOSPHATES**
radioprotective effects on mice, evaluation during fractional and prolonged irradiation, 20: 42992
**THORACIC VISCERA**
pulsations of, use of cinedensigraphy for recording, 20: 43028
**THORIUM**
analysis for boron, spectrochemical, 20: 43068(R) (IDO-14679, pp 47-50)
analysis of irradiated, for cesium-137 and uranium, 20: 43069(R) (IDO-14679, pp 51-9)
analysis of irradiated, for protactinium-233, 20: 43383
content in concrete raw materials, 20: 43514 (UCRL-16878)
content in soils, gamma spectrometric measurements of, 20: 43542
determination in metal and slugs with or without aluminum coating, titrimetric, 20: 43071 (IDO-14679, pp 75-191)
determination in ocean deposits, 20: 43550(R) (NYO-844-67)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
effects on growth of Paramecium cultures in shielded vessels, 20: 42886
machining procedures for, 20: 43864 (Y-1550)
neutron Doppler coefficients for rods of, with nonuniform temperature distributions, (E), 20: 45088
pressure bonding of tubular, in aluminum cans, 20: 43861 (TID-12860)
production and powder metallurgy of, in Brazil, 20: 43871
production and properties of, as nuclear fuel, 20: 45099
separation from americium-241 by solvent extraction, 20: 43072(R) (IDO-14679, pp 193-229)
separation from carbon, nitrogen, and oxygen by electrotransport, 20: 43820
separation from hydrochloric acid solutions by solvent extraction using TBP and DPSO, synergic effects on, 20: 43444
separation from pitchblende residues, leaching processes for, 20: 43420 (MCW-1508)
separation from protactinium by solvent extraction, 20: 43383
separation of, from sulfuric acid solutions of uranium by ion exchange, 20: 43147
separation of, from nitric acid solutions by solvent extraction using TBP, 20: 43450
sorption by bismuth iodate, 20: 43448
use in CANDU- and PHWR-type reactors, 20: 45105 (AEET-252)
use in crossed-progeny reactor fuel cycles, optimum, 20: 45096 (BNWL-289)
**THORIUM ALLOYS**
Pu–Th–U, burnup testing of, 20: 45106(R) (ANL-7249)
Th–U, processing of irradiated uranium-233-enriched, economic aspects of, 20: 43435
**THORIUM(IV) FLUORIDES**
$KF-ThF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
$LiF-ThF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
$NaF-ThF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
**THORIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
**THORIUM ISOTOPES Th-226**
energy levels of, rotational, (T), 20: 44843
**THORIUM ISOTOPES Th-227**
alpha decay, internal-conversion electron spectra accompanying, (E), 20: 44696
**THORIUM ISOTOPES Th-228**
distribution and properties of, in natural waters, 20: 43535
distribution from nuclear explosion in salt deposit, 20: 43802
separation from uranium-233, design of facility for, 20: 45094(R) (BAW-3460-2)
use as standard in radon-220 determination, 20: 43525
**THORIUM ISOTOPES Th-230**
determination in sulfuric acid solutions of uranium, 20: 43147
distribution and properties of, in natural waters, 20: 43535
use in age estimations for Pleistocene events, 20: 43557
**THORIUM ISOTOPES Th-232**
distribution and properties of, in natural waters, 20: 43535
energy levels of, octupole vibrational, (T), 20: 44825
neutron capture cross sections for, effects of $(n,\gamma n')$ reaction on, (T), 20: 44614 (CONF-660303, pp 613-22)
neutron fission at threshold delayed neutron yields in, (E), 20: 44672(T) (LA-tr-66-34)
**THORIUM ISOTOPES Th-234**
distribution and properties of, in natural waters, 20: 43535
preparation of carrier-free, 20: 43448
**THORIUM ORES**
radiation dose from, to rodents in Minas Gerais, Brazil, 20: 43606
**THORIUM OXALATES**
radiation effects on thermal decomposition of dihydrate of, kinetics of gamma, 20: 43363
**THORIUM OXIDES**
fracture and slip in single crystals of, (E), 20: 43943
separation of fission products from irradiated, using molten sodium chloride, 20: 43454
use as standard in determination of radon, 20: 43525
$Ta-ThO_2$, measurement of insulation heat loss of, 20: 43798(R) (ALO-3634-2)
**THORIUM(IV) OXIDES**
analysis for calcium, lithium, and potassium, spectrographic, 20: 43105
creep of polycrystalline at 1400 to 1800°C, mechanisms at 4000 to 11,000 PSI, 20: 43941
dispersion in nickel–uranium alloys, 20: 43902 (NMI-7018)
dissolution of aluminum-canned irradiated, in aluminum nitrate–hydrofluoric acid–nitric acid, 20: 43412 (DP-1044)
distribution in cells of rabbit knee joints, 20: 42772
effects on properties of tungsten powder, 20: 43899 (NASA-TN-D-3610)
neutron Doppler coefficients for rods of, with nonuniform temperature distributions, (E), 20: 45088
preparation of microspheres of, 20: 43182 (ORNL-TM-1508)
production of dense, by sol-gel process, 20: 43850 (CONF-660524-15)
radiation dose calculations, comparison with radium-224 and radium-226, 20: 43046
separation of uranium-233 from irradiated, processes for, 20: 43415 (ISO-SA-3(Rev.))
thermodynamic properties of, at high temperatures, 20: 43907 (ORNL-TM-1596)
$BeO-PuO_2-ThO_2$, nuclear parameters of fuel pellets of, 20: 45176
$BeO-ThO_2-UO_2$, radiation effects on dispersions of, effects of particle size on, in-reactor, 20: 44014
$Co-Ni-ThO_2$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
$Cr-Ni-ThO_2$, oxidation and properties of composite effects of high temperatures on, 20: 43845(R) (AD-637573)
$Mo-Ni-ThO_2$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
$Ni-ThO_2$, corrosion in oxidizing atmospheres at high temperatures, 20: 43842
$Ni-ThO_2$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
$Ni-ThO_2$, substructure of TD nickel, electron transmission microscopic studies, 20: 43882(R) (AD-636487)
$Ni-ThO_2-U$, agglomeration and segregation of thoria in, at 800°C, 20: 43902 (NMI-7018)
$Ni-ThO_2-W$, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
$ThO_2-UO_2$, fabrication and processing of powders of, 20: 45094(R) (BAW-3460-2)
$ThO_2-UO_2$, separation of uranium from, by chlorination and sublimation, 20: 43443
**THULIUM**
ionization potentials of, electron-impact method for measuring, 20: 43235
separation from aqueous solutions by solvent extraction using di-acidic phosphorus-based compounds, 20: 43445
**THULIUM ALLOYS**
Al–Tm, properties of intermetallic compounds in, tabulation of, 20: 43972
Co–Tm, crystal structure of intermetallic compound, 20: 43920
Mn–Tm, crystal structure of intermetallic compound, 20: 43918
**THULIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
**THULIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with glycolic and lactic acids, thermodynamic properties of, 20: 43215
**THULIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
**THULIUM ISOTOPES Tm-165**
gamma spectra, 20: 44634(R) (IDO-17188)
separation of neutron-deficient, from erbium-166, 20: [illegible]3067(R) (IDO-14679, pp 6-46)
**THULIUM ISOTOPES Tm-169**
gyromagnetic ratios, (E/T), 20: 44791
**THULIUM ISOTOPES Tm-170**
incorporation in tetrahydrated ammonium cerium sulfates, mixed crystal formation in, 20: 43252
production of, developments in commercial, 20: 43803
**THULIUM ISOTOPES Tm-172**
gamma spectra, 20: 44634(R) (IDO-17188)
separation from decay products and erbium-170 by cation exchange chromatography, 20: 43067(R) (IDO-14679, pp 6-46)

**THULIUM PERRHENATES**
preparation and properties of, 20: 43217
**THULIUM SYSTEMS**
graphite–Tm, preparation and properties of intercalation compounds in, (E), 20: 44999
**THYMIDINE**
effects of loading with, on rat metabolism, 20: 42806
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
incorporation of tritium-labeled, in organelles of DNA, 20: 42701(R) (ANL-7136, pp 205-30)
metabolism in *E. coli*, effects of ribosides on, 20: 42716(R) (UCRL-16246, pp 164-7)
metabolism of tritium-labeled, in mice, 20: 42738(R) (ANL-7136, pp 255-65)
radiation effects on catabolism of, in rats, x, 20: 42806
radiation effects on rat urinary excretion of, effects of thymidine injection on, 20: 42807
radioinduced inhibition of incorporation of, into DNA by mammalian cells *in vitro*, 20: 42777
tritium-labeled, use in studies of lymphoid cell functions, 20: 42784
**THYMINE**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
metabolism in *E. coli*, effects of ribosides on, 20: 42716(R) (UCRL-16246, pp 164-7)
**THYMUS GLAND**
cellular ultrastructure in, of mice suffering from radioinduced leukemia or thymic lymphoma, 20: 42882
effects of radioinduced leukemia on mouse, 20: 42867
radiation effects on lymphocyte content and morphology of, in infant mice, x, 20: 42880
radiation effects on thymocyte nuclei, effect of phosphate metabolism and respiration on x, 20: 42928
radiation effects on lymphoid tissue of chick, restoration after local and whole-body x, 20: 42935
radiation effects on cells of, in mice injected with 5-methoxytryptamine and cystamine, 20: 42938
radiation effects on, in mice centrifuged prior to gamma or proton exposure, 20: 42985
radioinduced lymphomas in mice, 20: 42892
stimulatory effects of mouse, on lymphoid regeneration of spleen, 20: 42984
**THYROID GLAND**
iodine-125 and -127 metabolism by rat, effects of simulated altitude on, 20: 42745(R) (UCRL-16246, pp 126-37)
iodine-131 content in humans in West Germany, 20: 43626
iodine-131 effects on, 20: 42857(R) (TID-23228)
iodoamino acids of, identification by gel filtration and automated iodine-127 determination, 20: 42774
radiation dose effects on metabolism in rats, x, 20: 43029
radiation dose to, of children in USA following nuclear weapons tests in Nevada, 20: 43590 (UCRL-14707)
radiation effects on human and rat, $\beta$ and x, 20: 42857(R) (TID-23228)
radiodiagnostic procedures for, iodine-131, 20: 42796
radioiodine uptake measurements, 20: 43031
**THYROID HORMONES**
tetraiodothyroacetic acid, effects on strontium-85 retention by mice, 20: 42769
triiodothyroacetic acid, effects on strontium-85 retention by bone in mice, 20: 42769
**THYRONINE, TRIIODO-**
effects on strontium-85 retention by bone in mice, 20: 42769
**THYROXINE**
effects on strontium-85 retention by bone in mice, 20: 42769
**TIMING CIRCUITS**
design of digital, for electrochemical studies, 20: 43067(R) (IDO-14679, pp 6-46)
**TIN**
analysis for trace amounts of copper by isotope dilution and activation methods, 20: 43137
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
electric conductivity of thin films of, charge effects on, 20: 44510
electric conductivity of liquid, to 2200°K, 20: 43179(R) (NYO-2082-6)
electric resistivity and superconducting properties of pure and cadmium-doped, anisotropic, 20: 44546
gamma scattering on, Mossbauer effect from, 20: 44149
reactions of liquid, with tungsten to 2200°K, 20: 43179(R) (NYO-2082-6)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
superconducting transition temperatures of, crystallite size effects on, 20: 44552
superconducting transition temperature of silver laminates with, 20: 44567
superconductivity of, effects of current pulses on, 20: 44511
**TIN ALLOYS**
wear and corrosion testing as journal bearing material, 20: 43823 (AECL-2566)
Al–Sn, deposition and performance as oxidation-resistant coating for niobium alloys, 20: 43827 (GTR-19)
Al–Sn, deposition and oxidation protection of coatings of, on niobium and niobium alloys, 20: 43836 (TID-17070)
Al–Sn, use of coatings of, for corrosion protection of niobium–zirconium alloys, 20: 43837 (TIM-823)
Bi–Sn, machining procedures for, 20: 43864 (Y-1550)
Bi–Sn, superconductivity, 20: 44554
Pb–Sn, superconducting transition temperatures of, 20: 44515
Pd–Sn, diffusion of deuterium and hydrogen in, 20: 43934
Sb–Sn, magnetic flux retention in hysteretic superconducting, 20: 44521
Sn–U, thermal conductivity of aluminum-clad plates of, 20: 43811(R) (BNWL-269, pp 1.1-28)
**TIN ISOTOPES**
separation of neutron-deficient antimony isotopes from, 20: 43067(R) (IDO-14679, pp 6-46)
**TIN ISOTOPES Sn-113**
preparation of carrier-free, 20: 43398
**TIN ISOTOPES Sn-125**
beta decay of, antimony-125 energy levels from, (E), 20: 44705
**TIN OXIDES**
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
**TISSUE CULTURES**
antibody synthesis in rat, effects of actonomycin D on, 20: 42835(R) (ANL-7136, pp 63-80)
radiation effects on thymidine metabolism in kidney-cell, tracer study, 20: 42837(R) (ANL-7136, pp 124-40)
radiation effects on hamster-cell, neutron and x, 20: 42841(R) (ANL-7136, pp 266-89)
radiation effects on growth of monolayer animal cell, RBE for $\alpha$ and $\gamma$, 20: 42943
radiation effects on survival of carcinoma cells in, high-energy electron, 20: 43018
radioinduced chromosome aberrations in kidney-cell, effects of infrared on frequency of x, 20: 42837(R) (ANL-7136, pp 124-40)
radioinduced loosening of colonies in HeLa cell, electron, 20: 42963
**TISSUE HOMOGENATES**
uptake of amino acids by proteins in chloroplast-containing fractions of bean leaf, 20: 42706(R) (NYO-2373-1)
**TISSUE TRANSPLANTS**
effects of bone marrow, on lethally irradiated rats, 20: 42956
radiation dose effects on mouse mammary carcinoma, x, 20: 43035
radiation effects on survival of renal, effects of Azathioprine on intraarterial $\beta$, 20: 43013(R) (ORO-2459-1)
radiation effects on survival of renal, in dogs and man, $\gamma$, 20: 43013(R) (ORO-2459-1)
radiation effects on survival of dogs with dual, localized x, 20: 43013(R) (ORO-2459-1)
**TISSUES**
analysis for beryllium, methods for, 20: 43108
cesium-137 content in chicken, 20: 42735
effects of benzeneboronic acids on, 20: 42840(R) (ANL-7136, pp 164-90)
enzyme activity in, tracer studies of, 20: 43118
lead-210 and polonium-210 content of, comparison of cigarette smokers with non-smokers, 20: 42952
measurement of radiation injuries in, correlated with dosimetry, 20: 43572 (BNWL-SA-816)
neutron absorbed dose in, use of computers for measurement of fast, 20: 43668(R) (ANL-7136, pp 1-16)
radiation dose to human, following inhalation of iodine-131- or isomeric technetium-99-labeled albumin, 20: 42797
radiation effects on mesenchymal, in rats, following localized radiation injuries in bone, x, 20: 42785
radiation effects on calcium content of plant, gamma, 20: 42916
radiographic density measurements, instrument for gamma, 20: 43049
role of calcium in radioinduced softening of fruit and plant, 20: 42815
**TITANIUM**
analysis for oxygen, activation, 20: 43111
coating by aluminum-base alloys, method for, 20: 43962
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in sintered and zone refined boron-10, spectrographic, 20: 43090(R) (TID-23342)
effects on coatability of niobium, 20: 43827 (GTR-19)
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)

effects on photometric determination of cerium in cast iron and steels, 20: 43143
electron reactions at 18 Mev, anomalous secondary electron emission from, 20: 44117
properties for coating metals, 20: 43880
thermal expansion of, linear, 20: 45106(R) (ANL-7249)

**TITANIUM ALLOYS**
Al–Cr–Fe–Mo–Ti, properties of, effects of high-temperature thermomechanical treatment on, 20: 43961
Al–Nb–Ti, properties at high temperatures, 20: 43963
Be–Ti, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Co–Ni–Ti, creep testing of Nivco, 20: 43815(R) (NASA-CR-54356)
Cr–Mo–Ti, phase conversions and properties of, 20: 43970
Cr–Ti–V, phase conversions and properties of, 20: 43970
Cr–Ti–V, radiation effects on mechanical and physical properties of, 20: 45106(R) (ANL-7249)
Cr–Ti–V, thermal expansion of, linear, 20: 45106(R) (ANL-7249)
Mo–Nb–Ti, mechanical and thermal properties of niobium-base, 20: 43940
Mo–Nb–Ti–U–Zr, ductility of uranium-base, effects of aging, forging, and rolling on, 20: 43883 (AD-637777)
Ni–Nb–Ti, phase diagrams of, ternary chemical compounds in, 20: 43971
Pu–Ti–U, burnup testing of, 20: 45106(R) (ANL-7249)
Ta–Ti, crystal structure of titanium-base, effects of quenching and tempering on, 20: 43979
Ti–U, combustion kinetics of, 20: 43612
Ti–U, corrosion by sodium at 550 to 750°C, 20: 45106(R) (ANL-7249)
Ti–V, corrosion in sodium at 650°C, 20: 43809 (BNL-50003)
Ti–V, fabrication of, equipment and techniques for, 20: 43846 (ANL-7127)
Ti–V, radiation effects on mechanical and physical properties of, 20: 45106(R) (ANL-7249)
Ti–V, superconducting magnetic field and surface current measurements for, 20: 44535
Ti–V, thermal expansion of, linear, 20: 45106(R) (ANL-7249)
Ti–Zr, ductility and thermal expansion, 20: 43964

**TITANIUM CARBIDES**
elastic properties at 4.2 to 298°K, (E), 20: 43942
preparation and properties of 100–1000 A particles of, 20: 43951

**TITANIUM IONS**
effects on cobalt determination in steel, 20: 43145

**TITANIUM ISOTOPES Ti-44**
gamma spectra, 20: 44634(R) (IDO-17188)

**TITANIUM ISOTOPES Ti-46**
energy levels from alpha inelastic scattering, vibrational, (E/T), 20: 44795
energy-level spin and transition from proton inelastic scattering, (E), 20: 44765
nuclear charge distribution in, measurement using electron scattering at 29 and 58 Mev, (E), 20: 44789

**TITANIUM ISOTOPES Ti-48**
energy levels, 20: 43550(R) (NYO-844-67)
energy levels from alpha inelastic scattering, vibrational, (E/T), 20: 44795

**TITANIUM ISOTOPES Ti-50**
energy levels from alpha inelastic scattering, vibrational, (E/T), 20: 44795
nuclear charge distribution in, measurement using electron scattering at 29 and 58 Mev, (E), 20: 44789

**TITANIUM OXIDES**
analysis of, for germanium, by photoactivation methods, 20: 43102
analysis of, for oxygen by proton activation methods, 20: 43127
decontamination efficiencies of sulfuric acid-activated, on cobalt-60-contaminated polyvinyl chloride, 20: 43385
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
$GeO_2$–$TiO_2$, determination of germanium in, by photoactivation methods, 20: 43102

**TITANIUM STEEL**
Cr–Mo–Ti, corrosion by sodium in loops, statistical analysis of data on, 20: 43826 (GEAP-4830)

**TITANIUM SYSTEMS**
B–Mo–Nb–Ti, mechanical and thermal properties of niobium-base systems, 20: 43940
B–Mo–Nb–Ti–Zr, mechanical and thermal properties of niobium-base, 20: 43940
C–Mo–Ti–Zr, fabrication and properties of TZC, 20: 43830(R) (NASA-CR-72029)
Cr–Si–Ti, deposition and performance as oxidation-resistant coating for niobium alloys, 20: 43827 (GTR-19)

**TOBACCO**
lead-210 and polonium-210 in cigarette, effects on tissues of smokers, 20: 42952
polonium-210 content in, 20: 43581(R) (NP-16245)
tumor formation on, genetic control of, 20: 42704 (BNL-967)

**TOLUENE**
deuterium exchange between, and ammonia, kinetics of, 20: 43216
effects on gamma radiolysis of 2-propanol solutions, 20: 43318
effects on polymerization of styrene, 20: 43339
radioinduced production in meats, 20: 42973
tritium exchange with, mechanism of self-induced, 20: 43268
benzene–toluene, tritium labeling of, 20: 43268

**TOLUENE, CHLORO-**
effects of gamma radiolysis of 2-propanol solutions, 20: 43318

**TOLUENE, ETHYL-**
radiolysis of isomers of, effects of temperature, scavenger, and dose on gamma, 20: 43359

**TOMATOES**
effects of space flight on chromosome aberrations in roots of, 20: 42909

**TOPOLOGY**
application to reactor criticality calculations, 20: 45079

**TOXICITY**
of lipiodol during renal angiography of dogs, 20: 43024

**TOXICOLOGY**
abstracts on, 20: 42747(R) (UR-49-687, pp 148-76)
abstracts on studies of radioelement, 20: 42746(R) (UR-49-687, pp 66-116)
of *Clostridium botulinum*, type E, 20: 43775

**TOXINS**
effects of *Clostridium botulinum*, type E, pathological, 20: 43775
immune reactions of guinea pig radiation chimeras to, 20: 42878
radiation effects on production by *Clostridium botulinum*, type E, on fish, effects of polythene packaging and vacuum exposure on γ, 20: 43779
radioinduced in food, 20: 43771
radioinduced in food, 20: 43772
radiosensitivity effects of bacterial, on mouse bone marrow stem cells, 20: 42831 (AD-635600)

**TRACER TECHNIQUES**
use of short-lived nuclides in medical research, 20: 43022
uses of, in Romania, 20: 43769

**TRACER TECHNIQUES (BIOLOGY)**
pyruvate carboxylase activity studies using manganese-54, 20: 42773
species specificity studies on DNA using tritium and phosphorus-32, 20: 42757
techniques for, 20: 42738(R) (ANL-7136, pp 255-65)
tritiated thymidine use in lymphoid cell function studies, 20: 42784
use of tritiated water in measurement of dipyridamole on coronary blood circulation in dogs, 20: 42763

**TRACER TECHNIQUES (BOTANY)**
methods for herbicide research, 20: 42742 (STI-PUB-113)

**TRACER TECHNIQUES (HYDROLOGY)**
sand movement in rivers, using chromium-51, 20: 43549 (NP-16200)
use in measurement of water flow rates, 20: 43662

**TRACER TECHNIQUES (METALLURGY)**
for diffusion of xenon from uranium nitride crystals, 20: 43981

**TRADESCANTIA**
effects of nucleic acids on repair of x-radioinduced chromosome aberrations in microspores of, 20: 42977(R) (ORO-2669-2)
radioinduced chromosomal aberration in, cytological studies of x, 20: 42706(R) (NYO-2373-1)

**TRANSFORMERS**
power, use of superconductors of niobium, aluminum, and beryllium in, 20: 44562

**TRANSISTORS**
performance in nuclear environments, enhancement of, 20: 43754 (EGG-1183-2046)
radiation effects on, anomalous photocurrent production in, 20: 43755 (SC-DC-66-1821)
radiation effects on electric properties of MOSFET, 20: 43752 (AD-635583)
use in electronic counters, 20: 43654

**TRANSITION METALS**
chemistry of oxygen-containing cations of, review on, 20: 43190
electric-dipole transitions in, operator for spin-forbidden, 20: 44124

**TRANSPLUTONIC ELEMENTS**
chemistry of, bibliography on, 20: 43055 (STI-PUB-21/19)
production of, neutron cross sections for, 20: 44602 (BNL-982)

**TRANSURANIC ELEMENTS**
energy levels of, interaction between rotational and vibrational, (T), 20: 44694
processing plant for, design and installation of piping and equipment for, 20: 43425 (ORNL-P-2406)
production in power reactors, 20: 43800 (BNWL-140(Rev.1))

**TRANSURANIUM PROCESSING PLANT**
equipment development and fabrication for, 20: 43425 (ORNL-P-2406)

**TREES**
radiosensitivity of Pinus seeds, γ, 20: 42850(R) (NYO-2043-130)

**TRIBENZYLAMINE**

solvent properties from niobium and tantalum, 20: 43446

**TRICHINOSIS**

immune reactions to, in guinea pigs, 20: 42835(R) (ANL-7136, pp 63-80)

**TRIETHYLAMINE**

effects on gamma radiation effects on aliphatic or aromatic ketones, ESR studies on, 20: 43313

**TRIISOOCTYLAMINE**

properties of, as ion exchange material for, 20: 43439

**TRINEUTRONS**

production in neutron reactions (n,p) with tritium at 20.8 Mev, (E), 20: 44809

**TRINO POWER REACTOR**

performance of, reliability of, 20: 45181

**TRIOCTYLAMINE**

benzene–$H_2SO_4$–trioctylamine–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
thenoyltrifluoroacetone–trioctylamine, solvent properties for iron and uranium, 20: 43434
thenoyltrifluoroacetone–trioctylamine, solvent properties for uranium (VI), 20: 43440

**TRITIUM**

beta spectra of, resolution of, from carbon-14 beta spectra by liquid scintillation counting, 20: 43098
content in Clinch River system, 20: 45216 (ORNL-3721)
determination in biological materials by liquid scintillation counting, combustion methods for, 20: 43128
determination in biological materials by scintillation counting, combustion method for use in, 20: 43139
distribution from nuclear explosion in salt deposit, 20: 43802
exchange with toluene, mechanism of self-induced, 20: 43268
hydrogen abstraction by recoil, theoretical treatment of, 20: 43408
incorporation in organelles of DNA by thymidine carrier, 20: 42701(R) (ANL-7136, pp 205-30)
incorporation into digoxin, method for, 20: 42722
neutron reactions (n,p) at 20.8 Mev, search for three-body neutron bound state in, (E), 20: 44650 (ORNL-P-2412)
neutron reactions (n,p) at 20.8 Mev, trineutrons from, (E), 20: 44809
nuclear wave function for ground state of, orthonormal expansion of, (T), 20: 44692
role in soil organic matter research, 20: 42795
thymidine-labeling, use in studies of lymphoid cell functions, 20: 42784
tracer use in DNA metabolism studies, 20: 42777
use as tracer in effect of dipyridamole on coronary blood circulation, 20: 42763
use in species specificity of reannealed animal DNA, 20: 42757

**TRITONS**

reactions (t,p) with nitrogen-14 at 11.95 Mev, nitrogen-16 energy levels from, (E), 20: 44730

**TROPOSPHERE**

fallout monitoring in, development of balloon-borne scintillation detectors for, 20: 43512(R) (ANL-7136, pp 315-27)

**TRYPTOPHAN**

radiation effects on heat and light-induced phosphorescence of, ultraviolet, 20: 42803
radiation effects on luminescence of frozen solutions of, in liquid nitrogen, ultraviolet, 20: 42804

**TUBERCULOSIS**

hazards of, in postattack environment, 20: 43588 (RM-5090-TAB)
incidence of, among survivors of Japanese atomic disasters 45 years of age or older at time of blast, 20: 42697 (ABCC-18-65)
radiotherapy of, in bones and joints, radium-224, 20: 43046

**TUBES**

burnout of, effect of flow throttling at inlet on, 20: 43478(R) (EURAEC-1620)
emissivity of titanate-coated beryllium, niobium–zirconium, and stainless steel, 20: 43816(R) (PWA-2877)
expansion of cladding, equipment for measuring, 20: 43960
fabrication of titanium–vanadium, equipment and techniques for, 20: 43846 (ANL-7127)
fabrication of Zircaloy, into TREAT capsules for urania testing, 20: 43989(R) (BNWL-269, pp 3.1-30)
magnetic field enhancement in superconducting, 20: 44532
pressure bonding of thorium, in aluminum cans, 20: 43861 (TID-12860)
temperature distribution along, containing boiling potassium, effect of vapor content on, 20: 43485

**TUMORS**

abstracts on research studies of, 20: 42720(R) (UR-49-687, pp 177-94)
analysis of, for inorganic constituents, by activation methods, 20: 43138
arsonazo serum albumin localization in mouse, 20: 42840(R) (ANL-7136, pp 164-90)
cells of Ehrlich ascites, relation between antigenic materials and virus particles on, 20: 42712(R) (UCRL-16246, pp 51-7)
cobalt phthalocyamine tetrasulfonate anion localization in mouse, 20: 42840(R) (ANL-7136, pp 164-90)
effects of radioinduced lymphoma, on thymic cell ultrastructure in mice, 20: 42882
effects of radioprotective compounds on the growth of Ehrlichs ascites, 20: 42998(R) (EUR-2992.f)
effects of radiosensitizer on phosphorus-32 uptake of irradiated, 20: 42776
effects of rapidly growing, on cell proliferation and life span of mice, 20: 42840(R) (ANL-7136, pp 164-90)
evaluation of radiotherapy for malignant testicular, 20: 43038
formation on tobacco plants, genetic control of, 20: 42704 (BNL-967)
growth rates pulmonary metastases, 20: 43033
incidence of lung and stomach, among Japanese surviving atomic disasters, 20: 42697 (ABCC-18-65)
localization of pulmonary, using various methods, 20: 43037
radiation effects on thyroid cell nuclei during formation of rat, $\beta$, 20: 42857(R) (TID-23228)
radiation effects on cells from mouse lymphoma, negative pion, 20: 42859(R) (UCRL-16246, pp 100-2)
radiation effects on dry mass of Ehrlich ascites, electron-beam and x-ray, 20: 42817
radiation effects on mouse mammary, following transplantation, x, 20: 43035
radiation injuries in human lymph system following therapy for, $\beta$, $\gamma$, or x, 20: 42976
radiation- and urethane-induced pulmonary, in mice of different strains, x, 20: 42891
radioinduced by deposited plutonium, in mice and rats, 20: 42997(R) (ANL-7136, pp 191-204)
radioinduced chromosome aberrations in human leukocytes following therapy of, 20: 42931
radioinduced in mice by external $\beta$ exposure, 20: 42840(R) (ANL-7136, pp 164-90)
radioinduced in rats, effects of implanted $\beta$ sources on, 20: 42840(R) (ANL-7136, pp 164-90)
radioinduced in rats by injected plutonium-239, 20: 42840(R) (ANL-7136, pp 164-90)
radioinduced in rat thyroids, nuclear changes in thyroid cells, 20: 42857(R) (TID-23228)
radioinduced mammary, in rats, neutron, 20: 42833(R) (ANL-7136, pp 16-46)
radioinduced, in thymus and thoracic ganglia of mice, 20: 42892
radioinduction of metastasis of, model for, 20: 42963
radiosensitivity of mouse, subjected to diurnal variation in exposure, x, 20: 43048
radiotherapy and surgery of malignant, of testis, 20: 43034
radiotherapy of abdominal, induction of enterocolitis, 20: 42994
radiotherapy of lymphomas, high-dose x, 20: 43014(R) (RLO-581-10, pp 33-6)
radiotherapy of papillomatosis of juvenile larynx, carcinoma development following, 20: 43023
radiotherapy of pharyngeal, radium and x, 20: 43042
radiotherapy of primary lung cancers, x, 20: 43041
radiotherapy of skin metastases arising from internal, 20: 43039
radiotherapy using neutron-capture techniques, 20: 42840(R) (ANL-7136, pp 164-90)
radiotherapy using sealed sources, treatment planning for surface, interstitial, and intercavitary, 20: 43021
therapy of lymphomas using nitrogen mustard, 20: 43014(R) (RLO-581-10, pp 33-6)
zinc-65 uptake by Ehrlich ascites, *in vitro*, 20: 42775

**TUNGSTEN**

analysis for trace elements by atomic absorption spectrophotometry, 20: 43154
coatings of, compatibility with alumina at high temperatures, 20: 43927
crystallization in argon, krypton, and vacuum, effects on properties and structure of, 20: 43937
determination by charged-particle reactions at 2 Mev, 20: 43097
effects on coatability of niobium, 20: 43827 (GTR-19)
effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
effects on photometric determination of cerium in cast iron and steels, 20: 43143
fabrication using high-temperature plasma, 20: 43873
helium ion reactions at 60 ev to 1 kev with surfaces of, entrapment during, 20: 44118
mechanical properties at high pressures and temperature, (E), 20: 43925
oxidation at high pressures and temperature, (E), 20: 43925
preparation and properties of 100–1000 A particles of, 20: 43951
properties of compacted powders of, methods of improving, 20: 43848(R) (BNWL-269, pp 5.1-36)
properties of, for fiber reinforcing nickel composites, 20: 43848(R) (BNWL-269, pp 5.1-36)

reactions with liquid bismuth and lead to their boiling points, 20: 43179(R) (NYO-2082-6)
reactions with liquid tin to 2200°K, 20: 43179(R) (NYO-2082-6)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
sorption of hydrogen by, desorption spectra studies of effects of deuterium in, 20: 43255
strength and structure of powdered, effects of additives on, 20: 43899 (NASA-TN-D-3610)
strength at high temperatures, effects of alloying on, 20: 43969

**TUNGSTEN ALLOYS**
coatings for, problems of protective, 20: 43877
Be-W, oxidation in air at 800 to 2200°F, 20: 43886(R) (BBC-111)
Cr-W, decomposition of solid solutions of, mechanism of, 20: 43914 (UCRL-16619)
Cu-Ni-W, ductility and tensile properties of tungsten-base, 20: 43822
Fe-Ni-W, ductility and tensile properties of tungsten-base, 20: 43822
Fe-Ni-W, ductility and strength of sintered composite, effects of tungsten content on, 20: 43885 (ASRL-TR-132-2)
Hf-Ta-W, fabrication and properties of T-111 for corrosion loops, 20: 43830(R) (NASA-CR-72029)
Hf-Ta-W, fabrication of T-111 tubes for corrosion loops, 20: 43831(R) (NASA-CR-72057)
Hf-Ta-W, joining of T-111 to type 316 stainless steel, 20: 43830(R) (NASA-CR-72029)
Hf-Ta-W, welding of T-111 to niobium-zirconium alloy, 20: 43830(R) (NASA-CR-72029)
Nb-W, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
Nb-W-Zr, coating of, with oxidation-resistant silicides, fluidized-bed process for, 20: 43881
Re-W, machining procedures for, 20: 43864 (Y-1550)
Ta-W, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
Ta-W, machining process for, 20: 43864 (Y-1550)
Ta-W, testing as container material for liquid plutonium-cobalt-cerium alloy fuel, 20: 43814 (LA-DC-7581)
Ta-W-Y, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)

**TUNGSTEN ARSENIDES**
crystal structure of $W_2As_3$, 20: 43187

**TUNGSTEN BRONZE**
preparation, properties, and structure of, phases with potassium, rubidium, and sodium, 20: 43213

**TUNGSTEN CARBIDES**
formation by explosive shock, 20: 43952
reactions of liquid, with liquid carbon in zirconium carbide, 20: 43179(R) (NYO-2082-6)
Co-WC, properties of sintered, effects of carbon and particle size on, 20: 43878
Co-WC, strength of, effects of hydrostatic support pressure on ultimate compressive, 20: 43909 (SC-DC-66-1888)
C-WC, machining procedures for, 20: 43864 (Y-1550)

**TUNGSTEN IONS**
effects on cobalt determination in steel, 20: 43145

**TUNGSTEN ISOTOPES**
energy levels of, rotational, (T), 20: 44843
neutron cross sections from 0 to 10 Mev, library of, 20: 44589 (WANL-TME-1472)

**TUNGSTEN ISOTOPES W-182**
energy levels of, octupole vibrational, (T), 20: 44825
energy-level transitions in deformed, E2, (E), 20: 44701
neutron capture cross sections from 0.01 to 10 ev, (E), 20: 44605 (CONF-660303, pp 182-203)
neutron cross sections from 0 to 10 Mev, library of, 20: 44589 (WANL-TME-1472)
neutron scattering cross sections at 0.3 to 1.5 Mev, optical-model analysis, (T), 20: 44646 (NAA-SR-11973)

**TUNGSTEN ISOTOPES W-183**
neutron capture cross sections from 0.01 to 10 ev, (E), 20: 44605 (CONF-660303, pp 182-203)
neutron cross sections from 0 to 10 Mev, library of, 20: 44589 (WANL-TME-1472)

**TUNGSTEN ISOTOPES W-184**
energy levels of, octupole vibrational, (T), 20: 44825
gamma spectra, 20: 44634(R) (IDO-17188)
meson ($\pi$) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
neutron capture cross sections from 0.01 to 10 ev, (E), 20: 44605 (CONF-660303, pp 182-203)
neutron cross sections from 0 to 10 Mev, library of, 20: 44589 (WANL-TME-1472)
neutron scattering cross sections at 0.3 to 1.5 Mev, optical-model analysis, (T), 20: 44646 (NAA-SR-11973)

**TUNGSTEN ISOTOPES W-186**
energy levels of, octupole vibrational, (T), 20: 44825
neutron capture cross sections from 0.01 to 10 ev, (E), 20: 44605 (CONF-660303, pp 182-203)
neutron cross sections from 0 to 10 Mev, library of, 20: 44589 (WANL-TME-1472)
neutron scattering cross sections at 0.3 to 1.5 Mev, optical-model analysis, (T), 20: 44646 (NAA-SR-11973)
nuclear data sheets, 20: 44713

**TUNGSTEN ISOTOPES W-187**
nuclear data sheets, 20: 44714

**TUNGSTEN ISOTOPES W-188**
nuclear data sheets, 20: 44715

**TUNGSTEN ISOTOPES W-189**
nuclear data sheets, 20: 44716

**TUNGSTEN OXIDES**
preparation of single crystals of, by chemical transport and growth from molten solutions, 20: 43257
$Li_2MoO_4$-$WO_3$, tungsten oxide single crystal growth in molten, 20: 43257
$Na_3AlF_6$-$WO_3$, tungsten oxide single crystal growth in molten, 20: 43257
$NaPO_3$-$WO_3$, tungsten oxide single crystal growth in molten, 20: 43257
$Nb_2O_5$-$WO_3$, phase diagram of, 20: 45012

**TUNGSTEN SYSTEMS**
Nb-O-W, crystal structure of $Nb_{16}W_{18}O_{94}$ in, 20: 43188
Ni-$ThO_2$-W, oxidation and properties of composite, effects of high temperatures on, 20: 43845(R) (AD-637573)
O-Ta-W, crystal structure of $Ta_{16}W_{18}O_{94}$ in, 20: 43188

**TYROSINE**
radiation effects on heat and light-induced phosphorescence of, ultraviolet, 20: 42803
radiation effects on luminescence of frozen solutions of, in liquid nitrogen, ultraviolet, 20: 42804

**TYRRHENIAN SEA**
radioactivity of plankton samples from, 20: 43536

**U**

**ULCERS**
radioinduced gastric, after $\gamma$ radiotherapy of lumbar lymph nodes, 20: 43019

**ULTRASONICS**
decontamination of rat skin contaminated with $^{131}I$, $^{32}P$, or $^{90}Sr$ by, 20: 42811
effects of, and gamma radiation on the treatment of food-spoilage microorganisms, 20: 43781
use in decontamination of metals, 20: 43623
use in dispersion and screening of soil sediments, 20: 42733
use in fuel tube inspection, 20: 43812(R) (BNWL-269, pp 4.1-9)

**ULTRAVIOLET RADIATION**
denaturing effect on properdin in blood serum, 20: 42823
effects on chromosomes in silkworm spermatocytes, 20: 42895
effects on content of DNA and RNA in *Paramecium caudatum*, 20: 42800(T) (ORNL-tr-1289)
effects on dark repairable blockage of DNA synthesis in *E. coli*, photoreactivation of, 20: 42812
effects on deuteriobromic and iodic acid systems with hydrogen, energy threshold and reaction cross sections for, 20: 43289 (CALT-532-2)
effects on development of fertilized frog eggs, 20: 42839(R) (ANL-7136, pp 154-61)
effects on DNA molecule, site and mechanism of action, 20: 42821
effects on *E. coli*, mechanisms of mutagenic, 20: 42918
effects on *Escherichia coli*, effects of acridine orange and oxygen on, 20: 42838(R) (ANL-7136, pp 140-54)
effects on hydrocarbons, chromatography equipment and method for analyzing products in, 20: 43288(R) (CALT-532-1)
effects on luminescence of chymotrypsin, tryptophan, and tyrosine, 20: 42804
effects on mammalian cells, photoreactivation of damage, 20: 42869
effects on *Moraxella bovis* infections in cattle, 20: 42863
effects on oxidative phosphorylation in *Mycobacterium phlei*, 20: 42810
effects on phosphorescence of proteins and aromatic amino acids, 20: 42803
effects on rat skin permeability to radon, 20: 42790
effects on thermoluminescence of calcites, 20: 43552
inactivation of t-RNA from *E. coli* by, 20: 42809
ionization effects on helium, in shock tubes, 20: 44980
ozone content of rooms for, 20: 43011

**UNDERGROUND EXPLOSIONS**
mineralogical investigation of debris of Gnome event, 20: 43464
radioisotope production in, 20: 43802

use of contained, industrial, 20: 43463 (UCRL-14756)
use of nuclear, in measurement of fission lifetimes, 20: 43460 (ORNL-P-2389)
**UNDERWATER EXPLOSIONS**
spalling from, in salt domes, 20: 43462 (UCRL-13225)
**UNITED STATES**
epidemiology of plague in, in post-attack environment, 20: 43587 (RM-4968-TAB)
food radiopreservation program in, 20: 43774
**URACIL**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
**URANIUM**
activity coefficient of plutonium in liquid, estimated, 20: 43819
analysis for gamma activity, equipment and methods for, 20: 43074 (LA-DC-7831)
analysis of irradiated, for fission products, 20: 43067(R) (IDO-14679, pp 6-46)
content in chondritic meteorites, 20: 44077
content in concrete raw materials, 20: 43514 (UCRL-16878)
content in fluorites, 20: 43564
content in soils, gamma spectrometric measurements of, 20: 43542
contents in international standards, 20: 43563
corrosion of Zircaloy-clad by steam at high pressures, 20: 43828 (HW-66911)
costs and requirements for 1970–1985, 20: 45118 (RISO-M-434)
density of reactor-grade, effects of annealing on, 20: 43958
density of, method of measuring, 20: 43958
deposition of, for target preparation, electrolytic, 20: 43396
determination by controlled-potential coulometry, 20: 43067(R) (IDO-14679, pp 6-46)
determination in aqueous and organic solutions, pellet fluorophotometric, 20: 43067(R) (IDO-14679, pp 6-46)
determination in aqueous and organic solutions, extraction-fluorophotometric, 20: 43071 (IDO-14679, pp 75-191)
determination in alloys and metals, extraction-spectrophotometric, 20: 43071 (IDO-14679, pp 75-191)
determination in biological materials, electrodeposition method for radiochemical, 20: 43405
determination in fuel elements, titrimetric, 20: 43067(R) (IDO-14679, pp 6-46)
determination in irradiated thorium by isotope dilution mass spectrometry, 20: 43069(R) (IDO-14679, pp 51-9)
determination in international standards by delayed neutron method, 20: 43563
determination in molten fluorides, electrochemical, 20: 43099
determination in ocean deposits, 20: 43550(R) (NYO-844-67)
determination in powder samples by spectrographic methods, semiquantitative, 20: 43104
determination in seawater by activation and gamma spectrometry, 20: 43059 (BNWL-SA-674)
determination in zircon, 20: 43565
determination of, from luminescence of adsorbed uranyl ion, chromatographic, 20: 43151
determination in metals, extraction-spectrophotometric, 20: 43067(R) (IDO-14679, pp 6-46)
diffusion in alpha-phase, thermodynamics of self, 20: 43928
disproportionation reactions in perchloric acid, 20: 43067(R) (IDO-14679, pp 6-46)
effects on determination of rare earths using halogenomandelic acids, 20: 43141
excretion in human urine as measure of body burden from, 20: 43000
heat capacity of $\alpha$, pressure effects on, 20: 44557
ignition in air and oxygen, mechanisms of, 20: 43611
occurrence in mortar sand for Roorkee University, India, 20: 43533
oxidation kinetics at 300 to 625°C, 20: 43841
processing of enriched, use of fluid-bed equipment for, 20: 43202
production and ingot-making of, in Brazil, 20: 43871
production and properties of, as nuclear fuel, 20: 45099
production of enriched and natural, in France, 20: 45239(R) (NP-16267)
production of, power reactor requirements for 1970–1985, 20: 45118 (RISO-M-434)
properties and purity of, for AEC purchase, program for determining, 20: 43070(R) (IDO-14679, pp 60-9)
properties as function of temperature, 20: 43983
radioinduced swelling of, mechanisms of, 20: 43995 (JAERI-4037)
recovery from low-enrichment fuels, 20: 45106(R) (ANL-7249)
reduction and dismutation in aqueous acetylacetone solutions, polarographic studies on, 20: 43205
separation by solvent extraction, preparation of secondary and tertiary amines for, 20: 43429
separation from americium-241 by solvent extraction, 20: 43072(R) (IDO-14679, pp 193-229)
separation from aqueous solutions by solvent extraction using TTA and 8-quinolinol, 20: 43432
separation from hydrochloric acid solutions by solvent extraction using thenoyltrifluoroacetone and trioctylamine, 20: 43434
separation from nitrate solutions, continuous peroxide precipitation method for, 20: 43414 (ISO-207)
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
separation from pitchblende residues, leaching processes for, 20: 43420 (MCW-1508)
separation from thorium dioxide–uranium dioxide systems by chlorination and sublimation, 20: 43443
separation from uranium–Zircaloy-2 alloy, by precipitation and extraction, 20: 43438
separation of protactinium from, by sorption on activated charcoal, 20: 43148
separation of, from thorium in sulfuric acid solutions by ion exchange, 20: 43147
separation of, from perchloric acid solutions by solvent extraction using thenoyltrifluoroacetone and trioctylamine, 20: 43440
spectral lines of, self-reversal in, 20: 44129
stress relaxation at high temperatures, analysis and curves for, 20: 43936
superconductivity of alpha-, colorimetric study of, 20: 44504 (UCRL-17026)
use in crossed-progeny reactor fuel cycles, optimum, 20: 45096 (BNWL-289)
valence of, in double oxysulfides and sulfides with potassium, 20: 43207
**URANIUM (Al CLAD)**
reactions with nitrogen at 470 to 1000°C, composition of uranium nitride produced by, 20: 43191
**URANIUM ALLOYS**
ignition of binary, effects on alloying additions on, 20: 43612
Zircaloy-2, separation of uranium from, by precipitation and extraction, 20: 43438
Al–Fe–Mn–U, intermetallic compounds of, phase diagrams, 20: 43980
Al–U, combustion kinetics of, 20: 43612
Al–U, formation of intermetallic compound, in high-temperature SAP-uranium reactions, 20: 43835 (RISO-91)
Al–U, oxidation of uranium-base, kinetics at 300 to 625°C, 20: 43841
Al–U, thermal conductivity of aluminum-clad plates of, 20: 43811(R) (BNWL-269, pp 1.1-28)
Al–U, use of powdered intermetallic compound, in dispersion fuel elements, 20: 43822
Be–U, combustion kinetics of, 20: 43612
Bi–U, combustion kinetics of, 20: 43612
Cr–U, crystal structure of, model of zonal dislocations in, 20: 43955
Cu–U, combustion kinetics of, 20: 43612
Cu–U, oxidation of uranium-base, kinetics at 300 to 625°C, 20: 43841
Fe–U, combustion kinetics of, 20: 43612
fizzium–Pu–U, burnup testing of, 20: 45106(R) (ANL-7249)
Mo–Nb–Ti–U–Zr, ductility of uranium-base, effects of aging, forging, and rolling on, 20: 43883 (AD-637777)
Mo–U, combustion kinetics of, 20: 43612
Nb–U, combustion kinetics of, 20: 43612
Pb–U, combustion kinetics of, 20: 43612
Pt–U, combustion kinetics of, 20: 43612
Pu–Th–U, burnup testing of, 20: 45106(R) (ANL-7249)
Pu–Ti–U, burnup testing of, 20: 45106(R) (ANL-7249)
Pu–U, processing of irradiated, economic aspects of, 20: 43435
Pu–U–Zr, burnup testing of, 20: 45106(R) (ANL-7249)
Ru–U, combustion kinetics of, 20: 43612
Sn–U, thermal conductivity of aluminum-clad plates of, 20: 43811(R) (BNWL-269, pp 1.1-28)
Ta–U, combustion kinetics of, 20: 43612
Th–U, processing of irradiated uranium-233-enriched, economic aspects of, 20: 43435
Ti–U, combustion kinetics of, 20: 43612
U–V, combustion kinetics of, 20: 43612
U–Zr, combustion kinetics of, 20: 43612
U–Zr, properties as function of temperature, 20: 43983
**URANIUM CARBIDES**
coating with pyrolytic carbon at 2300°C, fluid-bed methods for, 20: 43202
combustion kinetics of, 20: 43612
cost factors of, for fueling heavy water reactors, 20: 45185
crystal structure by neutron diffraction analysis, 20: 45002
elastic behavior of, relation to electronic structure, 20: 43942
gastrointestinal transit of ceramic spheres containing, uranium-235, in animals and man, 20: 42740 (LA-DC-7764)
machining procedures for, 20: 43864 (Y-1550)
preparation of spherical particles, from urania, 20: 43876
radiation testing of 304 stainless steel clad, 20: 45113 (NAA-SR-11440)

radiation testing of fuel pins of, 20: 45097(R) (WCAP-2972)
reactions with SAP at 450 to 600°C, 20: 43835 (RISO-91)
sintering of, development of additives for improved, 20: 43822
thermodynamic properties of, at high temperatures, 20: 43907 (ORNL-TM-1596)
thermodynamic properties, (T), 20: 43947
graphite–UC, electric and thermal conductivity at 20 to 1000°C, (E), 20: 43929

**URANIUM COMPLEXES**
with methionine, polarography and zone electrophoresis studies on, 20: 43229
with 2,4-pentanedione, reduction and dismutation of, polarographic studies on, 20: 43205

**URANIUM COMPOUNDS**
transport of, equipment and measurements for management in, 20: 43065 (GAT-T-1403)

**URANIUM(IV) FLUORIDES**
fluorine recovery on fluid-bed of, at 700 to 750°F, 20: 43199
preparation of, design of fluid-bed equipment for, 20: 43202
production by fluid-bed processing of uranium dioxide, method for estimating, 20: 43201
production by fluorination of uranium dioxide by fluid-bed method, 20: 43198
$KF-UF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
$LiF-UF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)
$NaF-UF_4$, density and molar volume of, 20: 43165 (BM-RI-6836)

**URANIUM(VI) FLUORIDES**
determination in vapor streams, instrumentation for continuous, 20: 43101
preparation of high-purity, by fluid-bed method, 20: 43200
preparation of, design of fluid-bed equipment for, 20: 43202
properties and purity of, for AEC purchase, program for determining, 20: 43070(R) (IDO-14679, pp 60-9)
reactions with fluorine at 700 to 750°F, 20: 43199
separation of fluorine from, fluid-bed method for, 20: 43199
transport of, sampling and weight control in, 20: 43062 (CONF-661011-1)

**URANIUM HYDRIDES**
separation of fission products, neptunium, and plutonium from irradiated, using phthalocyanine, 20: 43153

**URANIUM IODIDES**
oxidation of, by oxygen, kinetic studies of, 20: 43194

**URANIUM IONS**
charged distribution of 10- to 70-Mev stripped, 20: 44136
effects on cobalt determination in steel, 20: 43145
electrochemical reduction and oxidation of tetravalent, in molten fluorides, 20: 43099
oxidation of tetravalent to hexavalent, 20: 43185 (ZFK-WF-25)

**URANIUM ISOTOPES**
neutron fission of, energy dependence of delayed-neutron yield in, (E), 20: 44670(T) (INDSWG-101, pp 158-63)

**URANIUM ISOTOPES U-232**
energy levels of, octupole vibrational, (T), 20: 44825

**URANIUM ISOTOPES U-233**
fabrication of recycled, pilot plant operation for, 20: 45094(R) (BAW-3460-2)
neutron absorption cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron capture and fission cross sections, (E/T), 20: 44623 (CONF-660303, pp 840-72)
neutron fission cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron fission of, energy dependence of delayed-neutron yield in, (E), 20: 44670(T) (INDSWG-101, pp 158-63)
neutron multiplication factor and capture-to-fission ratios, (E), 20: 44626 (CONF-660303, pp 919-32)
neutron transmission through, (E), 20: 44604 (CONF-660303, pp 67-74)
separation from irradiated thoria, processes for, 20: 43415 (ISO-SA-3(Rev.))
separation from Purex Plant thorium run by anion exchange and peroxide precipitation, flow sheet for, 20: 43427 (RL-SEP-712)
separation from uranium-232 daughters, design of facility for, 20: 45094(R) (BAW-3460-2)
thermal fission of, yields from, 20: 43067(R) (IDO-14679, pp 6-46)

**URANIUM ISOTOPES U-234**
use in age estimations for Pleistocene events, 20: 43557

**URANIUM ISOTOPES U-235**
analysis for neptunium-237, extraction-radiometric, 20: 43072(R) (IDO-14679, pp 193-229)
clearance of uranium dioxide dusts of, from lungs of dogs, 20: 42767
effects in neutron fission in uranyl chlorides, 20: 44815
fission neutron yield of, calibration using Harwell plutonium-240 standard, 20: 44594
neutron absorption cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron capture and fission cross sections, (E/T), 20: 44623 (CONF-660303, pp 840-72)
neutron capture-to-fission ratios in low-power reactors, measurement of, 20: 45071 (CONF-660303, pp 1092-7)
neutron capture-to-fission ratio from 1 to 100 ev, (E), 20: 44648 (NRDC-117)
neutron fission and total cross sections for, comparison of multilevel and single-level effects on, (T), 20: 44630 (CONF-660303, pp 997-1003)
neutron fission at 0 to 25 kev and 170 to 770°K, Doppler effect on, (E/T), 20: 44627 (CONF-660303, pp 933-8)
neutron fission cross sections at 1 kev to 10 Mev, evaluation of published data on, 20: 44622 (CONF-660303, pp 796-808)
neutron fission cross sections below 0.5 ev, analytical fits to experimental data on, 20: 44629 (CONF-660303, pp 985-96)
neutron fission of, energy dependence of delayed-neutron yield in, (E), 20: 44670(T) (INDSWG-101, pp 158-63)
neutron fission of, dependence of total kinetic energy of fission fragments on mass ratio, (E), 20: 44673(T) (LA-tr-66-36)
neutron multiplication factor and capture-to-fission ratios, (E), 20: 44626 (CONF-660303, pp 919-32)
neutron resonance at 8.8 ev, spin measurement for, (E), 20: 44619 (CONF-660303, pp 755-62)
separation from hydrogen propellant in gaseous nuclear rocket, method for, (T), 20: 45201
thermal fission of, yields from, 20: 43067(R) (IDO-14679, pp 6-46)
use in neutron-capture therapy, 20: 42840(R) (ANL-7136, pp 164-90)

**URANIUM ISOTOPES U-236**
neutron cross sections and resonance integrals, 20: 44602 (BNL-982)

**URANIUM ISOTOPES U-238**
charge distribution in, from $\mu$-mesic atom hyperfine structure, (T), 20: 44721
clearance of uranium dioxide dusts of, from lungs of dogs, 20: 42767
deposition on metals, autoradiographic control of, 20: 43866
effects on natural uranium fuel performance in thermal reactor, 20: 45013 (AECL-2590)
fission of, yields from spontaneous, 20: 44815
meson ($\pi$) and nucleon reactions at 25 to 400 Mev, data from inelastic, (E), 20: 44720
neutron capture cross sections for, effects of (n,yn′) reaction on, (T), 20: 44614 (CONF-660303, pp 613-22)
neutron elastic scattering at small angles, anomalous, (E), 20: 44764
neutron fission cross sections at 1 kev to 10 Mev, evaluation of published data on, 20: 44622 (CONF-660303, pp 796-808)
neutron inelastic scattering, 20: 44613 (CONF-660303, pp 577-98)
neutron reactions (n,y) at 0 to 25 kev and 170 to 770°K, Doppler effect on, (E/T), 20: 44627 (CONF-660303, pp 933-8)
neutron resonance line shapes of, effect of chemical binding in uranium dioxide on, (T), 20: 45064 (CONF-660303, pp 134-45)

**URANIUM MINERALS**
analysis for uranium by delayed neutron method, 20: 43563
distribution in corona of ore bodies, 20: 43562

**URANIUM NITRATES**
preparation by electrolytic reduction of uranyl nitrate, 20: 43168 (DP-1065)
properties and purity of, for AEC purchase, program for determining, 20: 43070(R) (IDO-14679, pp 60-9)
separation of uranium from, continuous peroxide precipitation method for, 20: 43414 (ISO-207)

**URANIUM NITRIDES**
analysis for nitrogen, comparison of Dumas and Kjeldahl methods for, 20: 43109
diffusion of xenon from, tracer study of, 20: 43981
preparation by nitridation of uranium at 470 to 1000°C, 20: 43191
thermodynamic properties of, at high temperatures, 20: 43907 (ORNL-TM-1596)
PuN–UN, radiation effects on, 20: 43988(R) (BNWL-269, pp 2.1-11)

**URANIUM ORES**
deposition mechanisms, 20: 43562
distribution in corona of ore bodies, 20: 43562
leaching process for, reduction of chemical consumption in, 20: 43441
monitoring of atmosphere during mining of, 20: 43594(T) (AEC-tr-6763)
protactinium separation from other elements in, 20: 43148

**URANIUM OXIDES**
cost factors of, for fueling heavy water reactors, 20: 45185
dissolution in fuel sample with calcium and zirconium oxides, 20: 43069(R) (IDO-14679, pp 51-9)
hazards from, in manufacture of reactor fuels, 20: 43630
preparation from chloride and nitrate solutions by ammonium diuranate filtration, 20: 43428 (RL-SEP-924)
production of enriched, for reactor fuels, 20: 43874
properties and purity of, for AEC purchase, program for determining, 20: 43070(R) (IDO-14679, pp 60-9)

reduction and hydrofluorination of, fluid-bed process for, 20: 43200
separation of fission products from irradiated, using molten sodium chloride, 20: 43454
synthesis of substoichiometric, in mixtures with plutonium oxides, 20: 43811(R) (BNWL-269, pp 1.1-28)
$UO_x$–$U_2O_3$, vaporization mechanisms of, 20: 43900(R) (NBS-D-150)
$UO_x$–$Y_2O_3$, O/U ratios in, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$UO_x$–$Y_2O_3$, vaporization of, species produced by, 20: 43901(R) (NBS-D-154)
$UO_x$–$ZrO_2$, vaporization of, species produced by, 20: 43901(R) (NBS-D-154)

**URANIUM(III) OXIDES**
crystal structure of beta-phase, 20: 43921
$UO_2$–$UO_3$–$Y_2O_3$–$ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)

**URANIUM(IV) OXIDES**
chemical binding effects on neutron resonance line shapes in uranium-238, (T), 20: 45064 (CONF-660303, pp 134-45)
clearance of dusts of, from lungs of dogs, 20: 42767
electric conductivity of single-crystal, 20: 43811(R) (BNWL-269, pp 1.1-28)
fabrication of aluminum-clad pellets of, for Re-Suco critical assembly, 20: 43872
fabrication of fuels of, cost analysis of, 20: 45095 (BNWL-273(Vol.3))
fabrication of Zircaloy-clad capsules of, 20: 43989(R) (BNWL-269, pp 3.1-30)
fission gas release from irradiated, research program on, 20: 43992(R) (EURAEC-1667)
fluorination to produce uranium(IV) fluoride, method for estimation yield in fluid-bed, 20: 43201
fluorination to uranium(IV) fluoride, agitated fluid-bed reactor process for, 20: 43198
neutron spectra in tubes of, at 50 to 750°C, (E/T), 20: 45089
preparation by electrolysis of molten chlorides, 20: 43266(P)
preparation of microspheres of, 20: 43182 (ORNL-TM-1508)
preparation of, from uranium tetrachloride in alkali metal chloride melts, 20: 43185 (ZFK-WF-25)
pressure buildup in stainless steel capsules of, at high temperatures, 20: 43848(R) (BNWL-269, pp 5.1-36)
production of spheres of, methods for, 20: 43848(R) (BNWL-269, pp 5.1-36)
radiation effects on stoichiometry of, in-reactor, 20: 43811(R) (BNWL-269(p.1.1-28)
radiation testing of fuel pins of, 20: 45097(R) (WCAP-2972)
reactions with graphite at high temperatures, production of uranium carbide particles by, 20: 43876
reactions with SAP at 450 to 600°C, 20: 43835 (RISO-91)
scattering in, Raman, 20: 45015
separation of fission products, neptunium, and plutonium from irradiated, using phthalocyanine, 20: 43153
strength of particulate, crust, 20: 43811(R) (BNWL-269, pp 1.1-28)
thermodynamic properties of, at high temperatures, 20: 43907 (ORNL-TM-1596)
vapor pressure of, 20: 45106(R) (ANL-7249)
$Al_2O_3$–$UO_2$–$Y_2O_3$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
Al–$UO_3$–$U_3O_8$, fabrication into reactor fuel plates, 20: 43844 (AAEC-TM-315)
BeO–$ThO_2$–$UO_2$, radiation effects on dispersions of, effects of particle size on, in-reactor, 20: 44014
CaO–$UO_2$–$Y_2O_3$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$CeO_2$–$UO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$Eu_2O_3$–$UO_2$, phase studies, 20: 43853 (GEAP-5008)
$Eu_2O_3$–$UO_2$, sintering of, 20: 43853 (GEAP-5008)
$La_2O_3$–$UO_2$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
Mo–$UO_2$, development for fast reactor fuel, 20: 45100
$PuO_2$–$UO_2$, radiation effects compacted rods of, 20: 43812(R) (BNWL-269, pp 4.1-9)
$PuO_2$–$UO_2$, radiation effects on Zircaloy-clad at high exposures, 20: 43988(R) (BNWL-269, pp 2.1-11)
$PuO_2$–$UO_2$, radiation effects on clad fuel elements of, at high exposures, 20: 43989(R) (BNWL-269, pp 3.1-30)
$PuO_2$–$UO_2$, sintering of pellets of, development of chamotte process for, 20: 43865(T) (EURFNR-96F)
stainless steel–$UO_2$, extrusion of billets of, methods for, 20: 43848(R) (BNWL-269, pp 5.1-36)
$ThO_2$–$UO_2$, fabrication and processing of powders of, 20: 45094(R) (BAW-3460-2)
$ThO_2$–$UO_2$, separation of uranium from, by chlorination and sublimation, 20: 43443
$UO_2$–$PuO_2$, fabrication of, flowsheets for, 20: 43869
$UO_2$–$UO_3$–$Y_2O_3$–$ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
$UO_2$–$Y_2O_3$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$UO_2$–Zircaloy-4–$ZrO_2$, dissolution of fused, 20: 43067(R) (IDO-14679, pp 6-46)
$UO_2$–$ZrO_2$, thermal conductivity of aluminum-clad plates of, 20: 43811(R) (BNWL-269, pp 1.1-28)
U–$UO_2$, phase studies above 1130°C, 20: 43931

**URANIUM(IV-VI) OXIDES**
analysis for impurities, sensitivity limits for spectrographic, 20: 43079 (ORNL-TM-1590)
Al–$UO_3$–$U_3O_8$, fabrication into reactor fuel plates, 20: 43844 (AAEC-TM-315)

**URANIUM(VI) OXIDES**
vaporization of, species produced by, 20: 43901(R) (NBS-D-154)
$UO_2$–$Y_2O_3$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
$UO_2$–$ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)

**URANIUM PEROXIDES**
precipitation from nitrate solutions, 20: 43414 (ISO-207)

**URANIUM SILICIDES**
combustion kinetics of, 20: 43612

**URANIUM SULFIDES**
preparation, properties, and structure of US and $U_2S_3$, 20: 43263

**URANIUM SYSTEMS**
Ni–$ThO_2$–U, agglomeration and segregation of thoria in, at 800°C, 20: 43902 (NMI-7018)
U–$UO_2$, phase studies above 1130°C, 20: 43931

**URANYL ACETATES**
luminescence spectra of organic solutions of, 20: 43262

**URANYL CHLORIDE COMPLEXES**
with pyrazines, nitrogen donor capacity in, effects of methyl substitution on, 20: 43243

**URANYL CHLORIDES**
hydrolysis of, in alkali metal chloride melts to prepare uranium dioxide, 20: 43185 (ZFK-WF-25)
neutron fission of, role of uranium-235 in, 20: 44815
processing by ammonium diuranate filtration, 20: 43428 (RL-SEP-924)
KCl–LiCl–$UO_2Cl_2$, electrolysis of molten, at 500 to 600°C, 20: 43266(P)
KCl–$MgCl_2$–NaCl–$UO_2Cl_2$, electrolysis of molten, at 500 to 600°C, 20: 43266(P)

**URANYL IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
energy levels of, in potassium uranyl carbonate, 20: 43240
luminescence in adsorbed state, chromatographic determination of uranium by, 20: 43151
separation from aqueous solutions by solvent extraction using TTA and 8-quinolinol, 20: 43432

**URANYL NITRATES**
denitration and hydrofluorination of, to form uranium(VI) fluoride, fluid-bed process for, 20: 43202
fission yields of supercritical volume of solutions of, effect of reactivity addition rate and weak neutron source on, 20: 43618
luminescence spectra of organic solutions of, 20: 43262
processing by ammonium diuranate filtration, 20: 43428 (RL-SEP-924)
reduction by electrolysis, formation of uranous nitrate by, 20: 43168 (DP-1065)

**URANYL SULFATES**
solvent distribution in alkyl ammonium extraction systems, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
solvent distribution in amine extractants, interface and transferring species in, 20: 43424 (ORNL-P-2359)

**UREA, 1-(BIS(1-AZIRIDINYL)PHOSPHINYL)-3-(3,4-DICHLOROPHENYL)-**
use as chemosterilant for screw-worm flies, comparison with γ irradiation, 20: 42724

**UREA, 1-[3-(CHLOROMERCURI)-2-METHOXYPROPYL]-**
labeling with iodine-131, 20: 43397

**UREA, THIO-**
protective effects against alpha and gamma radiation of enzymes, 20: 42816

**URIDINE**
effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)

**URIDINE, 5-BROMO-2'-DEOXY-**
radiosensitizing effect on tumors, phosphorus-32 uptake, 20: 42776

**URIDINE, 5-IODO-2'-DEOXY-**
radiation effects on metabolism in rats, x, 20: 42835(R) (ANL-7136,

pp 63-80)
**URIDINES, 2'-DEOXY-**
  effects on yield of x-radioinduced chromosome aberrations in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
  radiation effects on rat excretion of, x, 20: 42806
  radiation effects on rat urinary excretion of, effects of thymidine injection on, 20: 42807
**URINE**
  analysis for beryllium, methods for, 20: 43108
  analysis for β-glucuronidase following radiotherapy of uterine carcinoma, 20: 43025
  analysis for determining plutonium oxide inhalation, 20: 43630
  analysis for ruthenium, oxidation method for, 20: 43129
  analysis of, for carbon-14 by separation as carbon dioxide and scintillation counting, 20: 43136
  calculation of radiostrontium excretion in human, 20: 42779
  cesium-137 content in human, 20: 42794
  content of thiamine and xanthuronic acid in, vitamin metabolism studies of, 20: 42793
  content of uranium in human, as measurement of body burden, 20: 43000
  radiation effects on content of aminoisobutyric acid, deoxyuridine, and thymidine in rat, 20: 42807
  radiation effects on total nitrogen, urea nitrogen, and ammonia nitrogen in dog, x, 20: 42939
  radiation effects on mucoprotein content of rat, x, 20: 42960
  radioactivity in human, following ingestion of iodine-131-labeled triolein, 20: 42782
**UTERUS**
  radiotherapy of carcinomas of, effects on urine β-glucuronidase, 20: 43025
  radiotherapy of cervical cancer of, iron content in patients receiving, 20: 42908

**V**

**VACCINES**
  radiation effects on uptake of heat-killed sulfur-35-labeled mycobacterial, by microsomes and mitochondria in rat spleen, x, 20: 42907
  radioprotective effects on mice, evaluation during fractional and prolonged irradiation, 20: 42992
  radiosensitivity effects of typhoid-paratyphoid, in dogs, x, 20: 42987
**VACUUM**
  effects on engineering materials in combination with cryotemperatures and radiation, 20: 43994(R) (FZK-290)
  effects on properties and structure of tungsten crystallized in, 20: 43937
**VACUUM PUMPS**
  characteristics of all-metal-exhaust, for mass spectrometer, 20: 43068(R) (IDO-14679, pp 47-50)
**VACUUM SYSTEMS**
  use of plastics in, 20: 43471
**VALINOMYCIN**
  effects on reduction of pyridine nucleotides in rat liver slices, 20: 42759
**VALLECITOS SUPERHEAT REACTOR**
  fuel element design and performance for, Mark III, 20: 45110 (GEAP-4793)
**VALVES**
  design of pneumatically actuated, 20: 43425 (ORNL-P-2406)
**VAN ALLEN RADIATION BELTS**
  electron flux in outer, temporal variations during geomagnetic storms of, (E), 20: 44454
  electron longitudinal drift in, effect of superimposed electric field on, (T), 20: 44434
  electrons in, formation of slow, 20: 44156
  proton longitudinal drift in, effect of superimposed electric field on, (T), 20: 44434
**VAN DE GRAAFF ACCELERATORS**
  use of 2-Mev, in radiation chemistry, 22: 43328
**VANADIUM**
  determination by charged-particle reactions at 2 Mev, 20: 43097
  determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
  effects on costability of niobium, 20: 43827 (GTR-19)
  effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
  effects on photometric determination of cerium in cast iron and steels, 20: 43143
  magnetic flux retention in hysteretic superconducting, 20: 44521
  reactions with europium in aqueous perchloric acid solutions, spectrophotometric studies on kinetics of, 20: 43228
  separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
  superconductivity of, Ginzburg-Landau parameter for, 20: 44537
  thermal expansion of, linear, 20: 45106(R) (ANL-7249)
**VANADIUM ALLOYS**
  Cr–Ti–V, phase conversions and properties of, 20: 43970
  Cr–Ti–V, radiation effects on mechanical and physical properties of, 20: 45106(R) (ANL-7249)
  Cr–Ti–V, thermal expansion of, linear, 20: 45106(R) (ANL-7249)
  Cr–V, corrosion in sodium at 650°C, 20: 43809 (BNL-50003)
  Cr–V, thermal expansion of, 20: 43964
  Mo–V, thermal expansion of, 20: 43964
  Nb–V, ductile-to-brittle transitions in, enhancement of, 20: 43893 (KAPL-3119)
  Nb–V, ductile-to-brittle transitions in, grain boundary effects on, 20: 43894 (KAPL-3146)
  Nb–V, thermal expansion of, 20: 43964
  Ti–U, corrosion by sodium at 550 to 750°C, 20: 45106(R) (ANL-7249)
  Ti–V, corrosion in sodium at 650°C, 20: 43809 (BNL-50003)
  Ti–V, fabrication of, equipment and techniques for, 20: 43846 (ANL-7127)
  Ti–V, radiation effects on mechanical and physical properties of, 20: 45106(R) (ANL-7249)
  Ti–V, superconducting magnetic field and surface current measurements for, 20: 44535
  Ti–V, thermal expansion of, linear, 20: 45106(R) (ANL-7249)
  U–V, combustion kinetics of, 20: 43612
**VANADIUM IONS**
  determination of tetravalent, in sulfate solutions using cerium sulfate and ferroin, titrimetric, 20: 43144
  effects on cobalt determination in steel, 20: 43145
**VANADYL IONS**
  spectra of aqueous solutions of, ESR, 20: 43184 (UCRL-17064)
**VELA PROJECT**
  seismic velocity determination and distance measurements in salt dome for Salmon Event, 20: 43551 (VUF-3015)
**VELOCITY**
  effects of, in combination with vibrations and x radiation on mouse genetics, 20: 42986
  effects of, on earth penetration by projectiles, 20: 45240 (SC-RR-66-376)
  effects on mouse genetics, 20: 42986
  effects on phage induction and viability of *E. coli* during space flight, 20: 42910
  measurement of ultracentrifuge rotor, by radiotelemetry, 20: 43637(R) (UCRL-16246, pp 168-75)
**VENTILATION**
  design and use of systems for, in radioisotope laboratories, 20: 43593(T) (AEC-tr-6642)
**VERMICULITES**
  sorptive properties for cesium and strontium, 20: 43130
  sorptive properties for cesium, 20: 43455
**VESSELS**
  design for shipment of radioactive materials, 20: 43492 (ORNL-TM-1312(Vol.2))
  design for shipping and storage of radioactive materials, 20: 43476(P)
  radioactivity in culture, for Paramecium growth studies, 20: 42886
**VIBRATIONS**
  analysis of nonlinear, in reactor components, 20: 45061
  effects of, in combination with acceleration and x radiation on mouse genetics, 20: 42986
  effects on mouse genetics, 20: 42986
  effects on phage induction and viability of *E. coli* during space flight, 20: 42910
**VIRGINIA**
  pegmatites in, age estimation of, 20: 43504(R) (COO-689-60, App.A-4)
**VIRUSES**
  control and pathology of diseases caused by, in domestic animals, 20: 42954
  inclusion of, in leukemic cells of mice, 20: 42882
  induction of leukemia in mice, 20: 42893
  particles of, relation to antigenic materials on Ehrlich ascites tumor cells, 20: 42712(R) (UCRL-16246, pp 51-7)
  radioinduced inactivation of, 20: 42954
  reactivation of polio-, at low temperatures after attenuation by x radiation, 20: 42966
**VISCOSITY**
  polyamino acid solutions, effects of gamma rays and pH, 20: 42826
**VITAMIN B**
  effects on erythropoietic index and iron content in patients receiving radiotherapy for uterine cancer, 20: 42908
  metabolism in dogs fed irradiated meat, 20: 42793
**VITAMIN C**
  effects on erythropoietic index and iron content in patients receiving radiotherapy for uterine cancer, 20: 42908
  effects on irradiated rat leukocytes, 20: 42948
**VITAMIN E**
  effect on radioinduced fatty acid peroxides in rabbit and rat aorta,

20: 42813
metabolism in dogs fed irradiated meat, 20: 42793
VITAMIN K
metabolism in dogs fed irradiated meat, 20: 42793
VITAMIN $K_5$
effects on gamma sensitivity of spores of food-spoilage fungi and yeasts, 20: 43784
VITAMINS
effects on irradiated rat leukocytes, 20: 42948
metabolism in dogs fed radiopasteurized meat, 20: 42793
radiation inactivation of, in fruits and vegetables, 20: 43781
VOLATILITY SEPARATION PROCESSES
economics of, for carbide, metal, and oxide fast-breeder reactor fuels, 20: 43410 (ANL-7137)
VOLCANOES
lead isotope contents in magmas from, 20: 43521
VOLTAGE REGULATORS
design and development of ultra-stable capacitive, 20: 43634 (SLAC-PUB-199)
design of patentiostat, 20: 43512(R) (ANL-7136, pp 315-27)

W

WARFARE
infectious disease problems in, postattack, 20: 43588 (RM-5090-TAB)
WASHINGTON
zinc-65 distribution in plankton from offshore waters of, 20: 43545
WASTE DISPOSAL
burial, packaging, and transport for, 20: 43069(R) (IDO-14679, pp 51-9)
contamination of surface waters by, 20: 43598
feasibility studies of, in Black Sea and tributaries, 20: 45227
feasibility studies of, in the Black Sea and tributaries, 20: 43539
Irish Sea, of low-activity radioactive effluent from Windscale, 20: 45229
marine, effects of high levels of zinc-65 on ecology of trophic level crustaceans, 20: 42731(R) (RLO-1751-2)
methods for, survey of, 20: 45222
monitoring for wastes from beryllium production plants, 20: 43629
monitoring of radioactive, at Savannah River Plant, January to June 1966, 20: 43577(R) (DPST-66-30-2)
nuclear underground explosions in, 20: 43463 (UCRL-14756)
practices used in disposal of radioisotopes in hospitals in Russia, 20: 42796
radiation hygiene in, review, 20: 43602
radioactivity from, in Tennessee River System, 20: 45216 (ORNL-3721)
requirements and problems related to high-activity at Eurochemic Reprocessing Plant, 20: 45232
salt mine, influence of stress, temperature, and radiation on flow and stability of, 20: 45217 (ORNL-P-2126)
sea, of radioactive residual water from La Hague Center, 20: 45228
zinc-65 in Pacific Ocean plankton from Hanford Reactor, 20: 43545
WASTE PROCESSING
cesium and strontium separation by absorption on vermiculite, leaching studies for, 20: 43130
dehydration of radioactive slimes, effects of polymers on, 20: 45218(T) (KFK-tr-201)
environmental effects of, at National Reactor Testing Station, 20: 45219
fixation in borosilicate glass of highly radioactive wastes from Risö, Roskilde, Denmark, 20: 45230
fixation in glass of concentrated fission product solutions from Marcoule, France, 20: 45231
fixation in glass of concentrated solutions of fission products, process at Fontenay-aux-Roses, France for, 20: 45233
fixation of radioactive in polysilicates, thermite process for, 20: 45226
incineration, design and operation of plants for, 20: 45214 (AEET-243)
methods for liquid, at Casaccia, 20: 45220
methods for, survey of, 20: 45222
system design for, at Rospo and Ispra-2 Reactors, 20: 45220
WASTE SOLUTIONS
analysis for gross beta activity, 20: 43072(R) (IDO-14679, pp 193-229)
analysis for low-level beta activity, 20: 43072(R) (IDO-14679, pp 193-229)
analysis for samarium-151 by isotope dilution mass spectrometry, 20: 43068(R) (IDO-14679, pp 47-50)
concentration at river mouths, 20: 45225
decontamination of, using Yazoo and Zilpha clays, 20: 45221
dilution, dispersion, and sedimentation in British estuaries, 20: 45224
discharge into Clinch River from ORNL, 20: 45223
disposal of low-activity, into Irish Sea, review of, 20: 45229
disposal of residual radioactive, from La Hague Center into sea, 20: 45228
processing systems for, at Rospo and Ispra-2 Reactors, 20: 45220
radionuclides in reactor, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
WATER
analysis for chlorine, radiochemical method for, 20: 43063 (EUR-2990.f)
analysis for oxygen, radiochemical method for, 20: 43064 (EUR-2991.f)
analysis for peroxide in reactor coolant, titrimetric, 20: 43071 (IDO-14679, pp 75-191)
analysis of, for cesium-137 and strontium-90 by beta-counting after chemical separation, 20: 43532
cesium-137 content in, Bombay, 1964 to 1965, 20: 43532
content in rat liver after gamma irradiation, effects of dietary casein level, 20: 42864
content in soils, cost comparison of neutron-moderation and gravimetric methods for determination of, 20: 43094
content in soils, measurement by neutron attenuation and scattering, 20: 43558
corrosive effects on aluminum coupled to copper and nickel, 20: 43824 (ANL-6236)
corrosive effects at pH 5 and 100°C of flowing, on potential HFIR materials, 20: 43833 (ORNL-TM-1030)
corrosive effects on steel in evaporator environments, review, 20: 43834 (ORNL-TM-1612)
decontamination effects of distilled, with ultrasonics on rat skin contaminated with $^{131}I$, $^{32}P$, or $^{90}Sr$, 20: 42811
determination in benzene from 10 to 60°C, isotopic dilution method for, 20: 43113
diffusion through lipid membranes, 20: 42725
droplet growth in vapor of, in expanding cloud chambers, (T), 20: 43674
effects of oxygen-17-enriched, on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
effects on chlorination of uranium (IV) oxide, 20: 43443
effects of radioinduced polymerization of styrene, 20: 43338
flow rates of, radiometric measurement of, 20: 43662
formation of, in radiolysis of *p*-benzhydroquinone and phenol, 20: 4332
gamma attenuation in, tables of equivalent thickness of, 20: 44989
interface with oil in rocks, determination of, 20: 43553
ionization by alpha particles and electrons, cross sections and mass spectra for, (E), 20: 44122
neutron background in, 20: 43547
neutron scattering laws for, 20: 44587 (NP-16291)
oxygen-17 spectra in enriched, effects of temperature on NMR, 20: 43171 (LA-DC-7394(Rev.))
oxygen-18 exchange between, and phenols and quinone in acidic media, mechanisms of, 20: 43276
physical properties of, at 32 to 690°F and high pressures, 20: 43173 (NAA-SR-Memo-12006)
production and methods of collection of, in combustion of samples for scintillation counting, 20: 43139
production of fresh, using dual-purpose reactors, 20: 45187
proton reactions at 160 Mev, proton production in, (E), 20: 44649 (ORNL-3887)
radiation chemistry of, structural model of hydrated electron in, 20: 43322
radiation effects on gastrointestinal absorption of, in rats, tracer study of x, 20: 42971
radioactivity content of, from fallout in West Germany, 20: 43626
radioinduced in baked glass bulbs, gamma, 20: 44011
radiolysis of, chemical yields from neutron and gamma, 20: 43377
radiolysis of, diffusion kinetics for alpha and gamma, (E/T), 20: 43288(R) (CALT-532-1)
radiolysis of, effects of deuterium on gamma, 20: 43352
reactions with Zircaloy-4 in LOFT experiment, 20: 45112 (IDO-17168)
recovery and storage of, use of underground explosions in, 20: 43463 (UCRL-14756)
spectra of, intensity measurements of absorption bands in, 20: 43178 (NRL-6394)
strontium-90 content in tap, in Belo Horizonte, Brazil, 20: 42999 (NP-15934)
strontium-90 content of, in Bombay, 1964 to 1965, 20: 43532
thermal conductivity of, device for measuring, 20: 43270 (AEET-245)
tracer study of balance of, with saline in human body, 20: 42782
use in shielding, cobalt-60 well irradiator, 20: 43613
x-ray scattering at 4 to 200°C, diffraction studies on, 20: 43180 (ORNL-3997)
acetonitrile–$H_2O$, effects on ESR spectra of oxygen-17-labeled benzoquinone, 20: 43224
benzene–$H_2SO_4$–trioctylamine–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
benzene–didecylamine–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, mass action and non-ideality in, 20: 43423 (ORNL-P-2354)
benzene-didecylamine–$Na_2SO_4$–$H_2SO_4$–$H_2O$, solvent properties for uranyl sulfate, interface and transferring species in, 20: 43424 (ORNL-P-2359)
steam–$H_2O$, heat transfer in circular pipes, 20: 43477 (CONF-661102-1)

steam–water, pressure pulsations in heat transfer by, 20: 43478(R) (EURAEC-1620)
steam–water, slip ratio of, at 212°F, 20: 43482 (ORNL-TM-1519)

WATER-*d*
uptake and distribution in intestinal tissues of dog, *in vitro*, compartmental analysis of, 20: 42748

WATER-$d_2$
deuterium exchange between, and aniline, effects of temperature and catalytic activity of cobalt, nickel, and platinum on, 20: 43275
diffusion through lipid membranes, 20: 42725
effects on beef heart aconitase and pancreatic lipase, 20: 42738(R) (ANL-7136, pp 255-65)
effects on rate of hydrolysis of 2,2,2-trifluoro-*N*-methylacetanilide, 20: 43280
neutron scattering laws for, 20: 44587 (NP-16291)
oxygen-17 spectra in enriched, effects of temperature on NMR, 20: 43171 (LA-DC-7394(Rev.))
solvent properties for azo dyes, isotope effects on role of intramolecular hydrogen bonds in, 20: 43287
spectra of, intensity measurements of absorption bands in, 20: 43178 (NRL-6394)
structure from 4 to 100°C, two-state theory of, 20: 44032
use in preparation of deutero-hydrocarbons, 20: 43409(P)
x-ray scattering at 4 to 200°C, diffraction studies on, 20: 43180 (ORNL-3997)

WATER COOLED REACTORS
accidents in, iodine deposition on surfaces following, 20: 45045(R) (BMI-X-10173)
coolant loss accidents in, metal–water reactions in, 20: 45112 (IDO-17168)

WATER MODERATED REACTORS
safety of, effects of neutron cross section uncertainties on, 20: 45068 (CONF-660303, pp 430-53)

WATER SUPPLIES
cesium-137 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)
desalination for Northeast U. S., potential, 20: 45186 (NP-16148)
maximum permissible limits for beryllium in, 20: 42755
strontium-90 content in, in Japan, 1960 and 1961, 20: 43518(T) (NSJ-tr-54)

WATER VAPOR
effects on initial sintering of calcia, 20: 43813(R) (COO-1122-3)

WEAPONS
cessation of testing of, effects on strontium-90 contamination in East Germany, 20: 43538
testing of, correlation with appearance of debris in New Zealand, 20: 43530

WEAR
factors affecting frictional, 20: 43788
measurement of, use of Kryptonate beta sources in, 20: 43765
tracer methods for, 20: 43788

WELDED JOINTS
fabrication of niobium loop for liquid metals, 20: 43879
mechanical properties of Hastelloy and Haynes 25, effects of aging on, 20: 43888 (BNWL-290(Pt.1))
radiation effects on Inconel and stainless steel, in-reactor, 20: 44027

WELDING
methods for refractory metals, 20: 43848(R) (BNWL-269, pp 5.1-36)
operator qualification standards for, 20: 43821

WELDS
etching of, procedures and reagents for, 20: 43821
testing of pressure-vessel, 20: 43851(R) (EURAEC-1671)

WELL LOGGING
equipment for radiometric, pulsed-neutron, 20: 43163(P)
neutron activation method of, for bauxite prospecting, 20: 43554

WHEAT
calcium uptake and distribution in, relation to strontium-90, 20: 42766
effects of space flight on chromosome aberrations in roots of, 20: 42909
mutagenesis in, effects of ethylenimine and x radiation on, 20: 42919
radiation effects on seeds of pure and hybrid, gamma, 20: 42897
radiation effects combined with ethylenimine on mutagenesis in durum, 20: 42919
radioinduced mutations in, x, 20: 42846 (IAEA-2466-13)
strontium-90 content in domestic and imported, in Finland, 1963 and 1964, 20: 43006
strontium-90 uptake and distribution in, relation to calcium, 20: 42766

WHISTLERS
propagation in magnetosphere, theory for group, 20: 44469
propagation of long-wave-emitted signals, optical path variation, (E), 20: 44429

WHITE OAK CREEK
radionuclide content in sediments of, 20: 45223
waste disposal in, radioactivity from, 1962 to 1963, 20: 45216 (ORNL-3721)

WHITESHELL REACTOR NO. 1
development, 20: 45183
development, 20: 45234 (AECL-2460)

WIND
effects on iodine-131 levels near Brookhaven Reactor, 20: 43608
effects on ionospheric F region, auroral-generated atmospheric, (E), 20: 44437
ionospheric, measurement by gun-launched projectiles, 20: 44447

WINDOWS
design for pressure vessel inspection, 20: 45062

WINDSCALE ADVANCED GAS COOLED REACTOR
fuel cycle for, analysis of, 20: 45180
waste disposal from fuel processing for, into Irish Sea, 20: 45229

WORMS
radiation effects on RNA content in regenerating *Polycelis nigra*, x, 20: 42933

X

X RADIATION
color centers in cesium bromides induced by, optical and thermal properties of, 20: 45036
color centers induced by, in potassium chlorides, 20: 45041(T)
detection of, design of 1–12 Å range scintillation detector for, 20: 43726
dose distribution of pelvic, using modified Marburg method, 20: 43047
dose effects on erythropoiesis in rats, 20: 42957
dose effects on recurrent mouse mammary carcinoma, 20: 43035
dose effects on thyroid metabolism in rats, x, 20: 43029
doses to human gonads from diagnostic, calculation procedure for, 20: 43026
dosimetry during fluoroscopy, parameters affecting, 20: 43050
dosimetry in bone and lungs using lithium fluoride thermoluminescent dosimeters, 20: 43747
dosimetry in pharyngeal phantom, 20: 43020
dosimetry of scattered, from therapeutic electron beam, 20: 43012 (BMwF-FBK-66-03)
dosimetry of, phantom for, 20: 43053(P)
effect on production of fatty acid peroxides in rabbit and rat aorta, 20: 42813
effects combined with urethan on tumor-resistant mice, 20: 42873
effects combined with ethylenimine mutagenesis in durum wheat, 20: 42919
effects in controlling immune responses following human kidney transplants, 20: 43032
effects of lethal doses on rats treated with bone marrow transplantations, 20: 42956
effects of local irradiation of heads of rats on spermatogenesis, 20: 42961
effects of pulsed, on peroxidation of *p*-xylene, 20: 43369
effects of pulsed, on amplitude distribution of boron trifluoride counters, 20: 43756
effects of single and fractionated doses on tumor induction in mouse thymus, 20: 42892
effects of soft, on excitation threshold of frog nerves, mechanisms for, 20: 42868
effects of therapeutic use on excretion of $\beta$-glucuronidase, 20: 43025
effects of, in combination with acceleration and vibrations on mouse genetics, 20: 42986
effects on allometry of radiosulfate metabolism and weight changes in mouse embryos, 20: 42765
effects on animals, lethal, 20: 42934
effects on animals treated with apilac, 20: 43009
effects on antibody synthesis in rats, 20: 42835(R) (ANL-7136, pp 63-80)
effects on antibody production in guinea pigs, 20: 42887
effects on antigen localization in rats, 20: 42835(R) (ANL-7136, pp 63-80)
effects on biological systems, standards for, 20: 43602
effects on blood enzyme activity in rats following whole-body exposure, 20: 42955
effects on bone metabolism in rats, 20: 42785
effects on brain and central regulation of electrocardiogram, 20: 42925
effects on calcium fluoride crystal absorption, fluorescence, and bleaching, 20: 45006
effects on carboxylation of n-pentane, 20: 43333
effects on carcinogenic effects of implanted plastic in rats, effects of exposure time on, 20: 42840(R) (ANL-7136, pp 164-90)
effects on chickens, pathological, 20: 42833(R) (ANL-7136, pp 16-46)
effects on chromosome aberration frequency in cultured kidney cells, 20: 42837(R) (ANL-7136, pp 124-40)
effects on chromosomes in *Crepis capillaris* sprouts, 20: 42936
effects on color centers, crystal structure, and optical properties of potassium chloride crystals, 20: 43306
effects on content of lymphocytes and morphology of thymus of infant

mice, 20: 42880
effects on cultured neoplastic mast cells, 20: 42834(R) (ANL-7136, pp 46-63)
effects on cultured hamster cells, biological, 20: 42841(R) (ANL-7136, pp 266-89)
effects on development of rats exposed *in utero*, pathological, 20: 42879
effects on development of autoimmunity following radiotherapy, 20: 43027
effects on dichloroacetamide, ESR studies of coupling in, 20: 43297
effects on dielectrics and lattice constants of lithium fluoride, effects of dose on, 20: 43307
effects on DNA molecule, site and mechanism of action, 20: 42821
effects on dogs, protective effects of typhoid-paratyphoid vaccine against, 20: 42987
effects on dominant and recessive genotypes of desynaptic barley mutants, 20: 42923
effects on dry mass of Ehrlich ascites tumors, 20: 42817
effects on *E. coli* RNA, 20: 42814
effects on Ephestia, effects of developmental stage on spectra of mutagenic, 20: 42970
effects on esterase activity in rats, 20: 42824
effects on ethyl mercaptan, ESR studies on, 20: 43320
effects on flower primordia formation in Xanthium, 20: 42842(R) (ANL-7136, pp 290-301)
effects on frequency of chromatid and chromosome aberrations in dry seeds of *Vicia faba*, 20: 42920
effects on gastrointestinal absorption of water in rats, 20: 42971
effects on glucose metabolism in rats, tracer study, 20: 42856 (TID-23213)
effects on glycoprotein and hexose content in blood serum in rats with hyperthyroidism, 20: 42805
effects on gonad development in fruit flies, 20: 42847(R) (NP-16176)
effects on ground squirrels, effects of hibernation and temperature on, 20: 42835(R) (ANL-7136, pp 63-80)
effects on growth of cells from mouse experimental fibrosarcoma, 20: 42888
effects on growth of Yoshida ascites sarcoma in rats, 20: 42962
effects on hamster cells *in vitro*, carcinogenic, 20: 42927
effects on hardness of crystals of potassium chloride and lithium fluoride, 20: 43304
effects on hematopoietic system in mammals, 20: 42844 (BNL-10385)
effects on hemolysin synthesis in rabbits, 20: 42835(R) (ANL-7136, pp 63-80)
effects on hibernating ground squirrels, lethal, 20: 42834(R) (ANL-7136, pp 46-63)
effects on human thyroid, 20: 42857(R) (TID-23228)
effects on immune reactions to tissue transplants, 20: 43013(R) (ORO-2459-1)
effects on immune reactions in rabbits, 20: 42855(R) (TID-23203)
effects on immune reactions in rabbits, 20: 42830 (AD-635598)
effects on insulin distribution in rats, tracer study of, 20: 42932
effects on leukemia induction in mice, 20: 42867
effects on leukocyte counts in rats administered endoxan, 20: 42965
effects on lymphatic dynamics, lymph nodes, and lymph vessels following cancer therapy, 20: 42976
effects on maize seed, biological RBE of, 20: 42843 (BNL-10358)
effects on metabolism in bone marrow and peripheral blood of whole-body irradiated rats, 20: 42788
effects on mice and rats, protective effects of sulfur and thiol compounds against, 20: 42998(R) (EUR-2992.f)
effects on mice, effects of AET and hypoxia on recovery from, 20: 42988
effects on mice, hematological fractionated-dose, 20: 42831 (AD-635600)
effects on mice, *in vitro* studies of lymphoid recovery following, 20: 42984
effects on mice, pathological, 20: 42833(R) (ANL-7136, pp 16-46)
effects on mice, protective effects of cysteine and MEA given intravenously or in water or gum arabic solution on, 20: 42997(R) (ANL-7136, pp 191-204)
effects on mice, protective effects of vaccines, thiophosphates, and AET against, 20: 42992
effects on mice, use of testis weight for evaluation of, 20: 42841(R) (ANL-7136, pp 266-89)
effects on microcirculation of rat mesentery, later response to serotonin, 20: 42978
effects on microhardness and dislocation mobility of sodium chloride crystals, (E), 20: 45005
effects on mortality in monkeys treated with antibiotics, blood platelets, and bone marrow, 20: 42980
effects on mouse epithelium, cytological, 20: 42834(R) (ANL-7136, pp 46-63)
effects on mouse genetics, 20: 42986
effects on mouse immunity to sarcoma J, 20: 42890
effects on mouse spermatogenic epithelium, pathological, 20: 42942
effects on mouse skin carcinogenesis in combination with dimethylbenzanthracene, 20: 42969
effects on mucoprotein excretion in rats following whole-body exposure, 20: 42960
effects on *Neurospora* chromosomes, nonallelic complementation studies, 20: 42926
effects on *Nitella flexilis*, biological, 20: 42998(R) (EUR-2992.f)
effects on osmoregulation in fish, 20: 42885
effects on population dynamics in Drosophila heterozygous or homozygous for irradiated chromosomes, 20: 42922
effects on proliferation of stem cells from cultured human lymphocytes, 20: 42872
effects on protein fractions in serum of rabbits injected with bone marrow and trace elements, 20: 42870
effects on protein metabolism in dogs, partial-body exposure, 20: 42939
effects on protein metabolism in rabbit ovaries, x, 20: 42941
effects on rabbit brain, pathological, 20: 42862
effects on rat blood and bone marrow, whole-body lethal, 20: 42955
effects on rat bone marrow, kinetics of hemopoietic regeneration following, 20: 42871
effects on rat mammary epithelium, relation to DNA synthesis, 20: 42840(R) (ANL-7136, pp 164-90)
effects on rats in state of hyperthermia, 20: 42959
effects on rats, metabolic, 20: 42835(R) (ANL-7136, pp 63-80)
effects on rats, testing of lysozyme as possible protective substance against, 20: 42993
effects on rectal mucous membrane of mice, effects of cysteamine on, 20: 42983
effects on RNA content in regenerating *Polycelis nigra*, 20: 42933
effects on Sabin poliovirus, following, 20: 42966
effects on *Schistosoma cercariae* infectivity in mice, 20: 42947
effects on serum levels of lysozyme in rats and rabbits, 20: 42944
effects on sheep, swine, and dogs, recovery from injuries from, 20: 42996
effects on space flight sensitized cultures of *Escherichia coli*, 20: 42912
effects on spin transfer in crystalline solid solutions, (E), 20: 43317
effects on survival time in mice protected by iproniazid or serotonin, 20: 42991
effects on syngenetic preference in mice, 20: 42889
effects on tensile strength of rat vibrissae, 20: 42834(R) (ANL-7136, pp 46-63)
effects on the brown-spots character of *Drosophila melanogaster*, 20: 42945
effects on the development of *Ascaridia galli*, 20: 42968
effects on thymic lymphoid tissue in chicks, restoration after local and whole-body exposure, 20: 42935
effects on thymidine catabolism in rats, 20: 42806
effects on thymocyte nuclei, effects of phosphate metabolism and respiration on x, 20: 42928
effects on Tradescantia chromosomes, cytological studies, 20: 42706(R) (NYO-2373-1)
effects on transformation of blood lymphocytes to blast cells in man, 20: 42903
effects on tumors in mice as affected by diurnal variations of exposure, 20: 43048
effects on ultramicroscopic structure of retina of rabbits, 20: 42958
effects on uptake of heat-killed sulfur-35-labeled mycobacterial vaccines by microsomes and mitochondria in rat spleen, 20: 42907
effects on *Vicia faba* meiosis, 20: 42921
effects on *Vicia faba*, protective effects of alcohols and inert gases against, 20: 43007
effects on wheat, genetic, 20: 42846 (IAEA-2466-13)
effects on zinc content of pancreas, 20: 42917
emission from solar flares, correlation with microwave bursts, 20: 44101
induction of lymphatic leukemia in mice, 20: 42893
inhibitory effects on thymidine incorporation into DNA by mammalian cells *in vitro*, 20: 42777
pathological characteristics of leukemic reticulosarcomatosis induced by, 20: 42729
production from discharges in spark chambers, 20: 43714
protective effects of post-irradiation oxygen starvation against injuries from, in rat thymocyte nuclei, 20: 42989
RBE for human body, 20: 42865
repair of chromosome aberrations induced by, in Tradescantia microspores, 20: 42977(R) (ORO-2669-2)
use as warning stimulus for rats, 20: 42852(R) (ORO-2903-28)
use for therapy of lymphomas, 20: 43014(R) (RLO-581-10, pp 33-6)
use for therapy of primary lung cancers, 20: 43041
use for therapy of pharyngeal cancers, 20: 43042
use for therapy of pharyngeal cancers, technique and dose distribution for, 20: 43020
use for therapy of skin metastases, 20: 43039
use in association with urethane to induce pulmonary adenomas, 20: 42891
use in plant breeding programs, 20: 42846 (IAEA-2466-13)

use in radiodiagnostic ionography, 20: 43028

**X-RAY BEAMS**
quality of, effects on dose to patient during fluoroscopy, 20: 43050

**X-RAY-DIFFRACTION ANALYSIS**
book: *Advances in X-Ray Analysis, Vol. 9*, 20: 43267
intensity measurements of irradiated samples during, automatic device for, 20: 43646

**X-RAY DIFFRACTOMETERS**
slit mount for, design of radiation proof, 20: 43661
use for analysis of deliquescent and pyrophoric samples, 20: 43068(R) (IDO-14679, pp 47-50)

**X-RAY EQUIPMENT**
book: *Advances in X-Ray Analysis, Vol. 9*, 20: 43267
design and use of autofluoroscope, 20: 43051
output of, effects on dose to patient during fluoroscopy, 20: 43050

**X-RAY FLUORESCENCE ANALYSIS**
bibliography on, 20: 43058 (AERE-Bib-136(Pt.2))
data for, of crystals, 20: 43057 (AAEC-TM-321)

**X-RAY SOURCES**
design of cadmium-109, for sediment gage, 20: 43561
detection and resolution at low-galactic longitudes, 20: 44091
detection of, in direction of north galactic pole, 20: 44095
preparation of iron-55, 20: 43384

**X-RAY SPECTROMETERS**
design for use in determination of light elements in solid samples, 20: 43161

**XENON**
absorption cross sections, (E/T), 20: 44642 (JINR-P-2808)
diffusion from uranium nitride, tracer study of, 20: 43981
effects on radiolysis of liquid propane, 20: 43368
fission fragment energy-losses in, (E), 20: 44685
glow discharges in, energy balance of steady-state, 20: 44961
magnetic field shift at xenon-129 nuclei in liquid and solid, local, (E), 20: 44142
magnetic field shift in solid, local, (T), 20: 44143
scattering of molecular beams of, by silver single crystals, (E), 20: 44121
sorption by boron nitrides, 20: 43067(R) (IDO-14679, pp 6-46)

**XENON COMPOUNDS**
radioinduced formation and retention of radioxenon in, Szilard-Chalmers effects in neutron, 20: 43373

**XENON FLUORIDES**
energy levels of, determination of semi-empirical molecular orbital, 20: 43237

**XENON IONS**
effects on gain of electron multiplier tubes, (E), 20: 43659
effects on glass surfaces up to 30 kev, 20: 45017

**XENON ISOTOPES**
radioinduced formation and retention in solid xenon compounds, neutron, 20: 43373

**XENON ISOTOPES Xe-124**
mass yield spectrum from cosmic-ray spallation reactions, (E), 20: 44079

**XENON ISOTOPES Xe-126**
mass yield spectrum from cosmic-ray spallation reactions, (E), 20: 44079

**XENON ISOTOPES Xe-128**
mass yield spectrum from cosmic-ray spallation reactions, (E), 20: 44079

**XENON ISOTOPES Xe-129**
magnetic field shift at nuclei of, in liquid and solid xenon, (E), 20: 44142

**XENON ISOTOPES Xe-130**
mass yield spectrum from cosmic-ray spallation reactions, (E), 20: 44079

**XENON ISOTOPES Xe-131**
determination of, by beta counting, ionization chamber for, 20: 43106
mass yield spectrum from cosmic-ray spallation reactions, (E), 20: 44079
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**XENON ISOTOPES Xe-132**
mass yield spectrum from cosmic-ray spallation reactions, (E), 20: 44079
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**XENON ISOTOPES Xe-133**
determination of, by beta counting, ionization chamber for, 20: 43106
determination simultaneously with xenon-135, equations for, 20: 43069(R) (IDO-14679, pp 51-9)

**XENON ISOTOPES Xe-134**
yields in thermal neutron fission of uranium-233 and -235, 20: 43067(R) (IDO-14679, pp 6-46)

**XENON ISOTOPES Xe-135**
determination simultaneously with xenon-133m, equations for, 20: 43069(R) (IDO-14679, pp 51-9)
energy levels from xenon-136 (d,t) reactions, (E), 20: 44842

**XENON ISOTOPES Xe-136**
deuteron reactions (d,p) and (d,t), xenon-135 and, 20: 44842

**XENON ISOTOPES Xe-137**
energy levels from, (E), 20: 44842
energy levels from xenon-136 (d,t) reactions ,(E), 20: 44842

**XENON ISOTOPES Xe-144**
half-life of, method for measuring, 20: 44706

**XYLENE**
radioinduced peroxidation of, pulsed-x, 20: 43369

# Y

**YANKEE POWER REACTOR**
fuel element cladding corrosion in, analysis of products from, 20: 45126 (WCAP-6072)
performance of, reliability of, 20: 45181
reactivity of, effects of fuel cladding corrosion products on, 20: 45126 (WCAP-6072)
safeguards, inspection procedures for, 20: 45108 (BNWL-119)

**YEASTS**
function of cytoplasmic granules during sporulation of, 20: 42702(R) (ANL-7136, pp 243-55)
radiation effects on alcohol dehydrogenase of, alpha and gamma, 20: 42816
radiation effects on, causing spoilage of fruit juices, 20: 43787
radiation effects on assays of, on fish fillets following refrigerated storage, gamma, 20: 43793
radioprotective activity of imidazole derivatives in, 20: 42979
radioprotective effects of lysates, on mice, 20: 42992
radiosensitivity of food-spoilage, effects of chemical radiosensitizers on γ, 20: 43784
radiosensitivity of, 20: 43787
radiosensitization by iodoacetamide, 20: 42901

**YTTERBIUM**
content in Gulf of Mexico surface water, 20: 43087(R) (TID-23295, Sect.4)
ionization potentials of, electron-impact method for measuring, 20: 43235
magnetic properties at 2 to 300°K, 20: 43939
spectra of, isotope shifts of resonance lines in, 20: 44133(T)

**YTTERBIUM ALLOYS**
Al–Yb, properties of intermetallic compounds in, tabulation of, 20: 43972

**YTTERBIUM CHLORIDES**
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222

**YTTERBIUM COMPLEXES**
with acetonitrile, pyridinium salts, and triphenylphosphonium, preparation and properties of, 20: 43231
with glycolic and lactic acids, thermodynamic properties of, 20: 43215

**YTTERBIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218

**YTTERBIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
preparation of cerium oxide single crystals containing, (E), 20: 43818

**YTTERBIUM ISOTOPES**
energy levels of, rotational, (T), 20: 44843

**YTTERBIUM ISOTOPES Yb-170**
energy-level transitions in deformed, E2, (E), 20: 44701

**YTTERBIUM ISOTOPES Yb-171**
energy levels of, g-factor and transition multipolarity for 66.7-kev, (E), 20: 44752
energy levels of, magnetic properties of K = ½ rotational band, (E), 20: 44753
gyromagnetic ratios ,(E/T), 20: 44791

**YTTERBIUM ISOTOPES Yb-172**
energy levels of, vibrational, (E/T), 20: 44797
energy levels of, octupole vibrational, (T), 20: 44825

**YTTERBIUM ISOTOPES Yb-173**
gyromagnetic ratios ,(E/T), 20: 44791
separation of lutetium-172 from, by cation exchange chromatography, 20: 43067(R) (IDO-14679, pp 6-46)

**YTTERBIUM ISOTOPES Yb-174**
energy levels of, vibrational, (E/T), 20: 44797

**YTTERBIUM ISOTOPES Yb-176**
neutron reactions (n,γ) with, energy-level transitions in isomeric ytterbium-177 from, (E), 20: 44709

**YTTERBIUM ISOTOPES Yb-177**
energy-level transitions in isomeric, from ytterbium-176 (n,γ) reactions, (E), 20: 44709

**YTTERBIUM NITRIDES**
magnetic properties at 2 to 300°K, 20: 43939

**YTTERBIUM PERRHENATES**
preparation and properties of, 20: 43217

**YTTERBIUM PHOSPHATES**
crystal structure of, infrared spectral studies on, 20: 43219

**YTTERBIUM SULFATES**
crystal structure of, infrared spectral studies on, 20: 43219
**YTTERBIUM SYSTEMS**
graphite–Yb, preparation and properties of intercalation compounds in, (E), 20: 44999
**YTTRIUM**
content in Gulf of Mexico surface water, 20: 43087(R) (TID-23295, Sect.4)
determination by charged-particle reactions at 2 Mev, 20: 43097
determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
determination of, in solution using Chrome Azurol S, spectrophotometric, 20: 43110
determination of, in mixture of rare earths, fluorimetric, 20: 43150
magnetic properties at 2 to 300°K, 20: 43939
nuclear magnetic fields in iron, (E), 20: 44824
separation from other elements by ion exchange using triisoöctylamine, 20: 43439
separation from promethium in fission product solutions, eluting agents for ion-exchange, 20: 43411 (BNWL-SA-677)
separation from strontium by ion exchange, 20: 43430
sorption by bismuth iodates, 20: 43448
**YTTRIUM ALLOYS**
Al–Y, properties of intermetallic compounds in, tabulation of, 20: 43972
Ta–W–Y, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
**YTTRIUM CHLORIDES**
radiation dose to gastrointestinal tract from ingested yttrium-90-labeled, 20: 43043
reactions with gaseous alkali and alkaline earth metals and hydrogen, thermodynamics of, 20: 43222
**YTTRIUM COMPLEXES**
with antipyrine-salicylates, benzene solvent extraction studies on, 20: 43256
with glycolic and lactic acids, thermodynamic properties of, 20: 43215
with 2,2′-dipyridyls, preparation and properties of, 20: 43258
**YTTRIUM FLUORIDES**
$KF-YF_3$, density and molar volume of, 43165 (BM-RI-6836)
$LiF-YF_3$, density and molar volume of, 20: 43165 (BM-RI-6836)
$NaF-YF_3$, density and molar volume of, 43165 (BM-RI-6836)
**YTTRIUM GERMANATES**
crystal structure of, ir spectral studies on, 20: 43218
**YTTRIUM HYDROXIDES**
properties as carrier for actinium-228, 20: 43442
**YTTRIUM IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
hydrolysis in aqueous solutions of sodium perchlorate at 25°C, constants for, 20: 43221
**YTTRIUM ISOTOPES Y-88**
gamma spectra, 20: 44634(R) (IDO-17188)
**YTTRIUM ISOTOPES Y-89**
proton reactions (p,n) at 8 to 14 Mev, neutron spectra from, (E), 20: 44739
**YTTRIUM ISOTOPES Y-90**
content in seawater, 20: 43688
effects on lymphatic dynamics, lymph nodes, and lymph vessels following cancer therapy, 20: 42976
effects on specific lymphopenia induction in dogs, 20: 42902
nuclear magnetic fields in iron, (E), 20: 44824
radiation dose to gastrointestinal tract from ingested, calculation of, 20: 43043
use for therapy of skin metastases, 20: 43039
**YTTRIUM ISOTOPES Y-91**
incorporation in tetrahydrated ammonium cerium sulfates, mixed crystal formation in, 20: 43252
**YTTRIUM ISOTOPES Y-95**
beta decay of, zirconium-95 energy levels from, (E), 20: 44722
**YTTRIUM NITRIDES**
magnetic properties at 2 to 300°K, 20: 43939
**YTTRIUM OXIDES**
physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
vaporization of, species produced by, 20: 43901(R) (NBS-D-154)
$Al_2O_3-UO_2-Y_2O_3$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$CaO-UO_2-Y_2O_3-ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$Ta-Y_2O_3$, measurement of insulation heat loss of, 20: 43798(R) (ALO-3634-2)
$UO_x-Y_2O_3$, vaporization mechanisms of, 20: 43900(R) (NBS-D-150)
$UO_2-UO_3-Y_2O_3-ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
$UO_x-Y_2O_3$, O/U ratios in, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$UO_2-Y_2O_3$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
$UO_x-Y_2O_3$, vaporization of, species produced by, 20: 43901(R) (NBS-D-154)
$UO_2-Y_2O_3-ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
$Y_2O_3-ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
$Y_2O_3-ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
**YTTRIUM PERRHENATES**
preparation and properties of, 20: 43217
**YTTRIUM PHOSPHATES**
crystal structure of, infrared spectral studies on, 20: 43219

## Z

**ZINC**
determination by charged-particle reactions at 2 Mev, 20: 43097
determination in plant materials, activation, 20: 43060 (CEA-R-2967)
determination in powder samples by spectrographic methods, semi-quantitative, 20: 43104
determination in seawater, activation, 20: 43085(R) (TID-23295, Sect.2)
determination of trace amounts of, in tungsten and molybdenum by atomic absorption spectrophotometry, 20: 43154
determination of, evaluation of titrimetric EDTA method with visual indicator end points for, 20: 43067(R) (IDO-14679, pp 6-46)
determination of, in carbazole by neutron activation methods, 20: 43116
production of bicrystal and single-crystal, equipment for, 20: 43910(R) (TID-23269)
proton total cross section at 17 Mev, (E), 20: 44662 (USC-136-111)
radiation effects on pancreas content, x, 20: 42917
reactions of gaseous, with rare earth chlorides, thermodynamics of, 20: 43222
separation by ion exchange using triisoöctylamine, effects of diluent on, 20: 43439
separation from lithium chloride solutions by oxine precipitation-carbon adsorption method, 20: 43092 (Y-1553)
**ZINC ALLOYS**
Bi–Zn, superconductivity, 20: 44554
Mg–Zn, exchange of plutonium in liquid systems with chlorides, thermodynamics of, 20: 43819
**ZINC COMPLEXES**
with DPTA and EDTA, effects on zinc-65 retention in rats, 20: 42789
**ZINC, DIMETHYL-**
spectra of hydrogen and lithium-7 in ether solutions of methyllithium complexes with, NMR, 20: 43393
**ZINC IONS**
effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
**ZINC ISOTOPES Zn-62**
separation of neutron-deficient, from copper-63, 20: 43067(R) (IDO-14679, pp 6-46)
**ZINC ISOTOPES Zn-64**
proton scattering by, isobaric analog states from, (E), 20: 44761
**ZINC ISOTOPES Zn-65**
content in reactor effluent, effect of $SiO_2$ on, 20: 45215 (BNWL-282)
distribution in plankton from offshore waters of Oregon and Washington, 20: 43545
distribution in protein fractions of guinea-pig serum, 20: 42791
distribution in water and silt of British estuaries, 20: 45224
effects on erythropoietic index and iron content in man, 20: 42908
metabolism by trophic level crustaceans of Northeast Pacific Ocean, 20: 42731(R) (RLO-1751-2)
metabolism in rats, effects of calcium- and zinc-chelates of EDTA and DPTA on, 20: 42789
uptake by Ehrlich ascites cancer cells *in vitro*, 20: 42775
**ZINC ISOTOPES Zn-66**
proton scattering by, isobaric analog states from, (E), 20: 44761
**ZINC ISOTOPES Zn-68**
proton scattering by, isobaric analog states from, (E), 20: 44761
**ZINC OXIDES**
effects of radioinduced polymerization of styrene, 20: 43338
radiation effects on catalytic activity of, in decomposition of hydrogen peroxide, 20: 43364
**ZINC SILICATES**
proton radiation effects at 30 kev on, luminescence emission, 20: 44035
**ZIRCALOY-2**
defects in tubular, sonic inspection of, 20: 43812(R) (BNWL-269, pp 4.1-9)
fabrication methods for, 20: 43425 (ORNL-P-2406)
fabrication of high-pressure capsules from tubes of, 20: 43989(R) (BNWL-269, pp 3.1-30)
performance on urania fuel elements in thermal cycling tests, 20: 43989(R) (BNWL-269, pp 3.1-30)
reactions with steam at high temperatures, 20: 43828 (HW-66911)

Zircaloy-2, separation of uranium from, by precipitation and extraction, 20: 43438
ZIRCALOY-4
  fabrication of, clad on zirconium–2.5 niobium pressure tubing, 20: 43862 (TID-23312)
  reactions with water in LOFT experiment, 20: 45112 (IDO-17168)
  $UO_2$–Zircaloy-4–$ZrO_2$, dissolution of fused, 20: 43067(R) (IDO-14679, pp 6-46)
ZIRCONIUM
  deformation and recovery of, electric conductivity study of, 20: 43959
  determination by charged-particle reactions at 2 Mev, 20: 43097
  determination in magnesium alloys, quantometric, 20: 43112
  determination in powder samples by spectrographic methods, semiquantitative, 20: 43104
  determination in seawater, spectrophotometric, 20: 43088(R) (TID-23295, Sect.5)
  diffusion kinetics of silver in alpha- and beta-, tracer studies of, 20: 43974
  dislocation behavior of polycrystalline, 20: 43892(R) (IITRI-578-P27-20)
  effects on coatability of niobium, 20: 43827 (GTR-19)
  effects on corrosion, stability, and strength of niobium, 20: 43905 (ORNL-3212)
  effects on properties of tungsten powder, 20: 43889 (NASA-TN-D-3610)
  machining procedures for, 20: 43864 (Y-1550)
  neutron absorption cross sections of, uncertainties in, 20: 45192 (CONF-660303, pp 88-90)
  properties for coating metals, 20: 43880
  separation from other elements by ion exchange using triisoöctylamine, 20: 43439
  separation of americium, curium, europium, and promethium from, by paper electrophoresis, 20: 43451
  separation of, from thorium in sulfuric acid solutions by ion exchange, 20: 43147
  surface properties of beta-phase annealed, effects of oxygen on, 20: 43933
  thermal expansion of alpha-phase, 20: 43956
  wear and corrosion testing of oxidized, as journal bearing material, 20: 43823 (AECL-2566)
  yield properties of polycrystalline, 20: 43892(R) (IITRI-578-P27-20)
ZIRCONIUM ALLOYS
  Be–Zr, properties at 1000 to 2100°F, effects of atmosphere and impurities on, 20: 43886(R) (BBC-111)
  Bi–Zr, superconductivity, 20: 44554
  Hf–Zr, ductility and thermal expansion, 20: 43964
  Mg–Zr, fatigue of, effects of high-frequency vibrations on, 20: 43957
  Mo–Nb–Ti–U–Zr, ductility of uranium-base, effects of aging, forging, and rolling on, 20: 43883 (AD-637777)
  Nb–W–Zr, coating of, with oxidation-resistant silicides, fluidized-bed process for, 20: 43881
  Nb–Zr, corrosion by molten plutonium alloys, carbon effects on, 20: 43829(R) (LA-3582)
  Nb–Zr, corrosion by lithium at 2000°F, 20: 43837 (TIM-823)
  Nb–Zr, emissivity of titanate-coated, at high temperatures, 20: 43816(R) (PWA-2877)
  Nb–Zr, fabrication of Zircaloy-4-clad pressure tubing of, 20: 43862 (TID-23312)
  Nb–Zr, fabrication of loops of, for liquid potassium and sodium, 20: 43879
  Nb–Zr, properties at high temperatures, compilation to 1957, 20: 43908 (PWAC-237)
  Nb–Zr, radiation effects on critical current peak vs magnetic field behavior of superconducting, 20: 44505
  Nb–Zr, superconducting properties of copper-enclosed, pressure effects on, 20: 44526
  Nb–Zr, superconducting critical field measurements for, resistive effects on surface, 20: 44534
  Nb–Zr, welding to T-111 alloy, 20: 43830(R) (NASA-CR-72029)
  Pu–U–Zr, burnup testing of, 20: 45106(R) (ANL-7249)
  Ti–Zr, ductility and thermal expansion, 20: 43964
  U–Zr, combustion kinetics of, 20: 43612
  U–Zr, properties as function of temperature, 20: 43983
ZIRCONIUM BORIDES
  oxidation at 1200 to 2000°K, kinetics of, 20: 43840
ZIRCONIUM CARBIDES
  containment in graphite crucibles at 3800 to 4700°K, 20: 43174 (NASA-CR-608)
  elastic properties at 4.2 to 298°K, (E), 20: 43942
  reactions of liquid, with liquid carbon in zirconium carbide, 20: 43179(R) (NYO-2082-6)
ZIRCONIUM COMPOUNDS
  machining procedures for, 20: 43864 (Y-1550)
ZIRCONIUM FLUORIDES
  determination in presence of hafnium fluorides by x-ray diffraction, 20: 43206
  properties of, comparison with hafnium fluorides, 20: 43206
  $BeF_2$–LiF–$ZrF_4$, electrochemical studies of uranium in molten, at 480 to 620°C, 20: 43099
ZIRCONIUM IODATES
  sorptive properties for actinides and lanthanides, 20: 43448
ZIRCONIUM IONS
  effects on cobalt determination in steel, 20: 43145
  effects on spectrophotometric determination of erbium, holmium, and neodymium, 20: 43100
ZIRCONIUM ISOTOPES Zr-90
  deuteron reactions (d,He-3) at 34.4 Mev, spin dependence of angular distributions from, (E/T), 20: 44800
  energy levels of, isobaric analogue, (T), 20: 44777
  gamma reactions ($\gamma$,n) and ($\gamma$,2n), cross sections for, (E), 20: 44660 (UCRL-70002)
  gamma reactions ($\gamma$,n) and ($\gamma$,p), mechanism of, (E), 20: 44778
ZIRCONIUM ISOTOPES Zr-91
  gamma reactions ($\gamma$,n) and ($\gamma$,2n), cross sections for, (E), 20: 44660 (UCRL-70002)
ZIRCONIUM ISOTOPES Zr-92
  gamma reactions ($\gamma$,n) and ($\gamma$,2n), cross sections for, (E), 20: 44660 (UCRL-70002)
  separation from neutron-deficient molybdenum-93m, 20: 43067(R) (IDO-14679, pp 6-46)
ZIRCONIUM ISOTOPES Zr-94
  gamma reactions ($\gamma$,n) and ($\gamma$,2n), cross sections for, (E), 20: 44660 (UCRL-70002)
ZIRCONIUM ISOTOPES Zr-95
  content in environment in Japan, 1961–64, 20: 43615
  content in nuclear debris over Sweden, 1962 to 1963, 20: 43524
  determination in seawater, spectrophotometric, 20: 43088(R) (TID-23295, Sect.5)
  distribution in water and silt of British estuaries, 20: 45224
  effects on determination of rhodium-106 and ruthenium-106 using coincidence methods, 20: 43158
  energy levels from beta decay of yttrium-95, (E), 20: 44722
  fractionation in fallout from Chinese and Russian tests, 20: 43528
  preparation and separation from niobium-95 by ion exchange, 20: 43433
  separation from irradiated uranium oxides using molten sodium chloride, 20: 43454
ZIRCONIUM OXIDES
  deformation on zirconium, mechanisms of anodic film, 20: 43949
  dissolution in fuel sample with calcium and uranium oxides, 20: 43069(R) (IDO-14679, pp 51-9)
  effects on properties of tungsten powder, 20: 43899 (NASA-TN-D-3610)
  electric resistivity of flame-sprayed coatings of, 20: 43927
  physical properties of, bibliography on, 20: 43911 (UCRL-6262(Pt.1))
  preparation of microspheres of, 20: 43182 (ORNL-TM-1508)
  radioinduced graft polymerization of styrene, vinylphosphonic acid dichloranhydride, and vinylpyridine on, 20: 43311
  thermal conductivity of powders of, under compressive stress, 20: 45056
  vaporization of, species produced by, 20: 43901(R) (NBS-D-154)
  CaO–$UO_2$–$Y_2O_3$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
  CuO–$Cu_2O$–$ZrO_2$, phase studies, 20: 43978
  $La_2O_3$–$UO_2$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
  $UO_2$–$UO_3$–$Y_2O_3$–$ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
  $UO_2$–$Y_2O_3$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
  $UO_2$–Zircaloy-4–$ZrO_2$, dissolution of fused, 20: 43067(R) (IDO-14679, pp 6-46)
  $UO_2$–$ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
  $UO_2$–$ZrO_2$, thermal conductivity of aluminum-clad plates of, 20: 43811(R) (BNWL-269, pp 1.1-28)
  $UO_x$–$ZrO_2$, vaporization of, species produced by, 20: 43901(R) (NBS-D-154)
  $Y_2O_3$–$ZrO_2$, phase equilibria in air at high temperatures, 20: 43901(R) (NBS-D-154)
  $Y_2O_3$–$ZrO_2$, phase studies of, after heating in air at 1400 to 1800°C, 20: 43900(R) (NBS-D-150)
ZIRCONIUM SYSTEMS
  B–Mo–Nb–Ti–Zr, mechanical and thermal properties of niobium-base, 20: 43940
  C–Mo–Ti–Zr, fabrication and properties of TZC, 20: 43830(R) (NASA-CR-72029)
ZIRCONIUM TITANATES
  performance as coating in beryllium emissivity tests, 20: 43816(R) (PWA-2877)
ZIRCONS
  age of, in Japanese granites, 20: 43556
  analysis for uranium, parameters influencing, 20: 43565

# REPORT NUMBER INDEX

Reports, conference papers and proceedings, numbered translations, and patents abstracted during the period are included in this index. Each item is listed by report number; this is followed by the abstract number and a brief notation regarding public availability. The index entries show which reports are on file in the depository libraries, which reports have been published in open-literature journals (journal citation given), and which reports can be purchased (source and price). Whenever a report is identified by more than one number, cross references from secondary to primary report numbers are cited.

The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(5th Rev.), *Report Number Series Used by the Division of Technical Information in Cataloging Reports*. This information is also included in the Cumulative Report Number Index (issued annually).

## Public Availability of USAEC Reports

All USAEC reports abstracted in *NSA* are available to the public through one or more of the following sources:

(1) Depository libraries in the United States, in other countries, and in international agencies. A list of these depositories appears on the inside covers of each issue of *NSA*.

(2) Scientific and technical journals or other publications.

(3) Microcard Editions, Inc., in Microcard and micronegative form. Orders and inquiries should be sent to: Accounting and Shipping Department, West Salem, Wisconsin 54669.

(4) Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Springfield, Virginia 22151.

(5) Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

## Public Availability of Non-AEC Reports

*U. S. Reports.* Many reports of U. S. Government agencies are available to the public from the Clearinghouse for Federal Scientific and Technical Information (CFSTI). This availability is given when known. Such reports should be ordered by AD number or NASA-N number. If availability is not shown, inquiries may be directed to CFSTI. In the case of NP numbers, inquiries should be by title and author.

*Non-U. S. Reports.* Many reports of atomic energy establishments of other countries are deposited in the libraries listed on the inside covers of each issue of *NSA*.

Additionally, the following have made their reports available as indicated.

AUSTRALIA

*Australian Atomic Energy Commission Research Establishment.* Available upon request from the Library, Australian Atomic Research Establishment, Private Mail Bag, Sutherland, New South Wales, Australia.

BELGIUM

*Centre d'Étude de l'Énergie Nucléaire.* Available upon request to individuals and organizations, from the Centre d'Étude de l'Énergie Nucléaire (CEN), 31, Rue Belliard, Bruxelles, Belgium.

CANADA

*Atomic Energy of Canada Limited.* For sale by the Technical Information Officer, Atomic Energy of Canada Limited, Chalk River, Ontario, Canada. Copies are also deposited in libraries in the United Kingdom.

*National Research Council of Canada.* Available from the National Research Council of Canada, Ottawa 2, Ontario, Canada.

DENMARK

*Atomic Energy Commission Research Establishment, Risø.* Available on exchange from the Library, Danish Atomic Energy Commission, Risø, Roskilde, Denmark. Also for sale by Jul. Gjellerup, Booksellers, 87 Sölvgade, København K., Denmark.

*Danatom.* Available on loan from Research Establishment, Risø, Roskilde, Denmark. Copies are available from Danatom, Aurehøjvej 2, Hellerup, Denmark.

EURATOM

Reports from the Commission of the European Atomic Energy Community are available from: Presses academiques europeennes, 98, chaussee de Charleroi, Brussels 6, Belgium; and Office central de vente des publications des Communautes eurodeennes 2, place de Metz, Luxemburg.

FRANCE

*Commissariat à l'Énergie Atomique.* Inquiries for reports numbered 1-2199 should be addressed to Commissariat à l'Énergie Atomique, Service Central de Documentation, Centre d'Études Nucléaires de Saclay, Boite Postale No. 2, Gif-sur-Yvette (S. et O.), France. Reports numbered 2200 and above are available from La Documentation Francaise, 16 Rue Lord-Byron, Paris VIII, France.

*Service Central de Protection contre les Rayonnements Ionisants.* Copies are available from Ministère de la Santé Publique, Service Central de Protection contre les Rayonnements Ionisants, B. P. n° 35—LE VESINET (S. et O.), France.

GERMANY

*Deutsches Elektronen-Synchrotron DESY.* Copies are available from Deutsches Elektronen-Synchrotron Desy, Dokumentation, 2000 Hamburg-Gr. Flottbek 1, Notkestieg 1, Germany.

*Gesellschaft für Kernforschung mbH (KFK).* Copies are available from Gesellschaft für Kernforschung mbH, 75 Karlsruhe, Postfach 947, Germany. Copies are also deposited in many national nuclear centers in the world.

*Kernforschungsanlage.* Copies may be ordered from Zentralbibliothek der Kernforschungsanlage Jülich, Jülich, Bundesrepublik Deutschland.

*Hahn-Meitner-Institute für Kernforschung.* Available without charge from Hahn-Meitner-Institute für Kernforschung Berlin, Bibliothek, Glienicker Strasse 100, 1 Berlin

39, Germany. Copies are deposited in many national nuclear centers in the world.

*Johann-Wolfgang-Goethe Universität, Frankfurt Am Main, Institut für Kernphysik, (IKF).* Copies are available from Gmelin Institut, 40-42 Varrentrappstrasse, Frankfurt (Main), West Germany.

### ISRAEL

*Israel Atomic Energy Commission.* Available without charge from Ministry of Defence/Atomic Energy Commission, Soreq Research Establishment, Yavne, Israel. Copies are deposited in libraries in Israel and in other countries.

### ITALY

*Centro Informazioni Studi Esperienze (CISE).* For sale at CISE Press Office, Casella Postale 3986, Milano, Italy. Copies are deposited in libraries in Italy.

*Comitato Nazionale per l'Energia Nucleare.* Copies are available from Comitato Nazionale per l'Energia Nucleare, Divisione Affari Internazionali e Studi Economici, Ufficio Pubblicazioni, Via Belisario, 15, Roma, Italy.

### JAPAN

*Japan Atomic Energy Research Institute (JAERI).* Available from the Staff Supply Cooperative of Japan Atomic Energy Research Institute (JAERI), 1-1 Tamura-Cho, Shiba, Minato-Ku, Tokyo, Japan. Copies are deposited in depositories in Tokyo, Nagoya, and Osaka.

*Nagoya University.* Copies are available from Research Information Center, Institute of Plasma Physics, Nagoya University, Nagoya, Japan.

*University of Tokyo.* Available free of charge from Institute for Nuclear Study, University of Tokyo, Tanashi-Machi, Kitatama-gun, Tokyo, Japan.

### NETHERLANDS

*Reactor Centrum Nederland.* For sale by Reactor Centrum Nederland, 112 Scheveningseweg, 's-Gravenhage, The Netherlands. Copies are deposited in university libraries in Holland and in many national nuclear centers in the world.

### NEW ZEALAND

*Institute of Nuclear Sciences.* Copies are available from Librarian, Institute of Nuclear Sciences, D.S.I.R., Private Bag, Lower Hutt, New Zealand. Copies are deposited in other countries.

### NORWAY

*Forsvarets Forskningsinstitutt.* Copies available from Norwegian Defence Research Establishment, Library, P. O. Box 25, Kjeller, Norway.

*Institutt for Atomenergi.* "KR" reports are available on an exchange basis from the Library, Institutt for Atomenergi, Box 40, Kjeller, Norway. Other series are not generally available to the public.

*Norwegian Reactor School.* Copies are available from The Library, Institutt for Atomenergi, P. O. Box 40, Kjeller, Norway.

### PAKISTAN

*Atomic Energy Center.* Copies are available from Atomic Energy Center, P. O. Box 658, Lahore, (West Pakistan).

### POLAND

Reports of the Polish nuclear institutes are published by the Nuclear Energy Information Center of the Government Commissioner for Use of Nuclear Energy. Copies are available from Ośrodek Informacji o Energii Jądrowej, Warszawa, PKiN, Poland.

### SPAIN

*Junta de Energia Nuclear.* "JEN" reports are available without charge from Servicio de Documentation, Junta de Energia Nuclear, Ciudad Universitaria, Madrid (3), Spain.

### SWEDEN

*Aktiebolaget Atomenergi.* "AE" reports are for sale from Aktiebolaget Atomenergi, Library Section, Box 43041, Stockholm 43, Sweden. Bibliographies and literature surveys of the VDDIT- series may be obtained from Aktiebolaget Atomenergi, Information Office, Scientific and Technical Information, Box 43041, Stockholm 43, Sweden. Other series are not generally available to the public. Organizations in the atomic energy field may obtain copies from Aktiebolaget Atomenergi. Microcopy of AE reports is available from the International Documentation Centre, Tumba, Sweden.

### SWITZERLAND

*CERN European Organization for Nuclear Research.* Available without charge from CERN European Organization for Nuclear Research, Geneva 23, Switzerland. Copies are deposited in libraries in 13 countries.

*Eidgenössisches Institut für Reaktorforschung.* "EIR" reports are available from Eidgenössiches Institut für Reaktorforschung, c/o Bibliothek, Würenlingen/Ag, Switzerland.

### TURKEY

*Turkish Atomic Energy Commission.* Copies are available free of charge from T.A.E.C., Çekmece Nuclear Research Center, P. O. Box 1, Airport, Istanbul, Turkey.

### UNITED KINGDOM

*United Kingdom Atomic Energy Authority.* Some reports are for sale in the United States by the British Information Service (BIS), 845 Third Avenue, New York, N. Y. 10022. United Kingdom reports generally may be purchased from Her Majesty's Stationery Office, London. Copies not for sale by Her Majesty's Stationery Office may be purchased in microcopy form from Micro Methods Limited, East Ardsley, Wakefield, Yorks, England. Report copies are deposited in a large number of libraries in England, depositories of the USAEC in the United States and abroad, and in most national nuclear centers throughout the world.

## Conferences

Published conference proceedings as well as individual unpublished papers from conferences are included in this index. A CONF number is assigned to the conference if published proceedings are received and also if only a single paper is received. The base number used is year-month-sequence. Thus, the number CONF-650101 would indicate that the conference was held in 1965, in January, and that this was the first January 1965 conference so received. This number would be assigned to complete published proceedings, or if individual papers are received, the base number would be extended to include a paper number, i.e., CONF-650101-1. As additional papers are received, they will be assigned consecutive numbers in the series, CONF-650101-1, 2, 3, 4, etc. This numbering system ensures that all papers received from a conference will be associated with that conference in this index.

If published proceedings are received after the receipt of individual papers, the complete proceedings will be abstracted and the abstract number will appear in this index with the base CONF number.

## Abbreviations Used in Availability Column

| | |
|---|---|
| AECL | For sale by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada. |
| BIS | For sale by British Information Service, 845 Third Avenue, New York, N. Y. 10022 |
| CFSTI | For sale by the Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Spring- |

| | |
|---|---|
| | field, Virginia 22151. The symbol "cy" indicates that the format of the item sold may be either a printed document or a photographic reproduction (two-thirds of original size) depending upon the availability of printed stock. The indicated price is for either format. The symbol "mn" is used to indicate that copy is also available in the form of micronegatives (microfiche). |
| Dep. | AEC reports: Full-size copy is on deposit in the depository libraries both inside and outside the United States. These reports are also for sale by Microcard Editions, Inc., Accounting and Shipping Department, West Salem, Wisconsin 54669.<br>Non-AEC reports: Full-size copy on deposit in the depository libraries in the United States only. |
| Dep.(mc) | Same as for Dep., except copy is in Microcard form. |
| Dep.(mn) | Same as for Dep., except copy is in micronegative (microfiche) form. |
| DSIR | For sale by the National Lending Library for Science and Technology (D.S.I.R.), Boston Spa, Yorkshire, England. |
| DTI Extension | Available from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37830. |
| EM | Blueprints and microcopy of AEC engineering drawings are available from Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Springfield, Virginia 22151. Current prices of the CAPE- packages may be obtained from this address. TID-4100, available from the Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee 37831, contains information on all the CAPE- packages for sale. |
| Gmelin | Available at a nominal charge and under the AED- number shown from Atomic Energy Documentation Center, Gmelin Institute, 40-42 Varrentrappstrasse Frankfurt (Main), West Germany. |
| GPO | For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. |
| HMSO | Her Majesty's Stationery Office, London. |
| IAEA | Available from the International Atomic Energy Agency, Vienna, Austria, and from its sales agencies in various countries throughout the world. A list of these agencies is found in each STI/DOC and STI/PUB publication. |
| JCL | For sale by the Special Libraries Association Translation Center, John Crerar Library, 35 West 33rd Street, Chicago, Illinois 60616. |
| LC | For sale by the Library of Congress, Photoduplication Service, Washington, D. C. 20540. |
| NAS | National Academy of Sciences, National Research Council, Washington, D. C. 20418. |
| NRC | For sale by the National Research Council of Canada, Ottawa, Ontario, Canada. |
| ORAU | Available on interlibrary loan from the Library, Oak Ridge Associated Universities, Post Office Box 117, Oak Ridge, Tennessee 37830. |
| ORINS | See ORAU. |
| UKAEA, London | Available from United Kingdom Atomic Energy Authority, 11 Charles II Street, London, S. W. 1. |
| UN | United Nations Bookshop, United Nations Headquarters, New York, New York. |
| USGS | Available free of charge from the U. S. Geological Survey, Washington, D. C. 20242. |
| ZLDI | Zentralstelle Für Luftfahrtdokumentation Und-Information, Maria-Theresia-Strasse 21, Munich 27, Germany. |

[The symbols "ph," "mf," and "fs" are used to designate that copy is available only in photostat, microfilm, or facsimile form. The symbol "mn" is used to designate that copy is available in micronegative (microfiche) form. The symbol "cy" is used to designate full size or photographically enlarged copy (two-thirds of original size).]

| Report No. | Abstract No. | Availability |
|---|---|---|
| **NUMERICAL** | **(Misc.)** | |
| 66-CNA-305 | 20-45101 | Dep. mn |
| 66-CNA-320 | 20-45102 | Dep. mn |
| **AAEC-TM–** | **(Australian)** | |
| 315 | 20-43844 | Dep. mn |
| 318 | 20-43985 | Dep. mn |
| 321 | 20-43057 | Dep. mn |
| **ABCC–** | | |
| 0-65 | 20-42696 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 18-65 | 20-42697 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 58-59 | 20-42827 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 59-60 | 20-42828 | Dep. mn. CFSTI $4.00 cy, $1.00 mn |
| **AD–** | **(Misc.)** | |
| 623557 | 20-43666 | CFSTI $3.00 cy, $0.75 mn |
| 625251 | 20-43566 | CFSTI $1.00 cy, $0.50 mn |
| 628065 | 20-44402 | CFSTI $1.00 cy, $0.50 mn |
| 628143 | 20-44403 | CFSTI $1.10 cy, $0.50 mn |
| 628179 | 20-44404 | CFSTI $1.10 cy, $0.50 mn |
| 628320 | 20-44415 | CFSTI $2.00 cy, $0.50 mn |
| 628506 | 20-44850 | CFSTI $30.70 cy, $1.50 mn |
| 628528 | 20-44163 | CFSTI $3.00 cy, $0.50 mn |
| 628777 | 20-44851 | CFSTI $2.60 cy, $0.50 mn |
| 628806 | 20-43495 | CFSTI $5.00 cy, $1.25 mn |
| 629924 | 20-44852 | CFSTI $3.00 cy, $0.75 mn |
| 630040 | 20-44853 | CFSTI $1.00 cy, $0.50 mn |
| 630074 | 20-44854 | CFSTI $4.00 cy, $0.75 mn |
| 630172 | 20-44108 | CFSTI $1.10 cy, $0.50 mn |
| 633448 | 20-43293 | CFSTI $5.00 cy, $1.00 mn |
| 635167 | 20-42829 | CFSTI $1.00 cy, $0.50 mn |
| 635583 | 20-43752 | CFSTI $3.00 cy, $0.75 mn |
| 635598 | 20-42830 | CFSTI $1.00 cy, $0.50 mn |
| 635600 | 20-42831 | CFSTI $1.00 cy, $0.50 mn |
| 635820 | 20-43567 | CFSTI $1.00 cy, $0.50 mn |
| 636487 | 20-43882 | CFSTI $2.00 cy, $0.50 mn |
| 636773 | 20-43753 | CFSTI $1.00 cy, $0.50 mn |
| 636787 | 20-43568 | CFSTI $3.00 cy, $0.50 mn |
| 637068 | 20-44044 | CFSTI $7.49 cy, $2.00 mn |
| 637212 | 20-42710 | See TID-23348 |
| 637573 | 20-43845 | CFSTI $3.00 cy, $0.75 mn |
| 637685 | 20-44987 | CFSTI $2.00 cy, $0.50 mn |
| 637777 | 20-43883 | CFSTI $1.00 cy, $0.50 mn |
| 637937 | 20-43986 | CFSTI $1.00 cy, $0.50 mn |
| 639436 | 20-44416 | CFSTI $3.00 cy, $0.75 mn |
| 639694 | 20-43667 | CFSTI $3.00 cy, $0.75 mn |
| **AEC-tr–** | **(For complete listing see TID-4025)** | |
| 6633 | 20-43639 | Dep. CFSTI $6.00 cy, $1.25 mn |
| 6642 | 20-43593 | Dep. CFSTI $5.00 cy, $1.00 mn |
| 6671 | 20-44869 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 6673 | 20-44870 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 6763 | 20-43594 | Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.10 fs, $0.80 mf |
| 6798 | 20-43515 | Dep. mn. CFSTI $3.00 cy, $0.50 mn. JCL $5.60 fs, $1.82 mf |
| **AECL–** | **(Canadian)** | |
| 2298(Vol.4) | 20-43759 | Dep. mn. AECL $1.00 |
| 2433 | 20-43113 | Can. J. Chem., 44: 1361-7(1966) |
| 2460 | 20-45234 | Dep. mn. AECL $1.50 |
| 2471 | 20-44689 | Can. J. Phys., 44: 1985-93(1966) |
| 2481 | 20-44693 | Can. J. Phys., 44: 2111-30(1966) |
| 2566 | 20-43823 | Dep. mn. AECL $2.00 |
| 2590 | 20-45103 | Dep. mn. AECL $0.50 |
| 2592 | 20-43465 | Dep. mn. AECL $0.50 |
| **AED-C–** | **(Non-AEC)** | |
| 13-04 | 20-43569 | Dep. mn |
| **AEET–** | **(Indian)** | |
| 239 | 20-45104 | Dep. mn |
| 243 | 20-45214 | Dep. mn |
| 244 | 20-43570 | Dep. mn |
| 245 | 20-43270 | Dep. mn |
| 252 | 20-45105 | Dep. mn |
| **AEEW-R–** | **(British)** | |
| 480 | 20-45063 | Dep. BIS $1.40. HMSO 7s. 0d. |
| **AERE-Bib–** | **(British)** | |
| 136(Pt.2) | 20-43058 | Dep. BIS $1.20. HMSO 6s. 0d. |
| **AERE-M–** | **(British)** | |
| 1783 | 20-45022 | Phys. Lett., 23: 18-19(1966) |
| **AERE-R–** | **(British)** | |
| 5120 | 20-45055 | J. Nucl. Energy: Pts. A and B, 20: 521-36(1966) |
| 5176 | 20-45016 | Phil. Mag. (8), 14: 637-45(1966) |
| **AFCRL–** | **(Non-AEC)** | |
| 66-6 | 20-44415 | See AD-628320 |
| 66-88 | 20-44852 | See AD-629924 |
| 66-604 | 20-43667 | See AD-639694 |
| **AFOSR–** | **(Misc.)** | |
| 65-2213(Pt.1) | 20-44404 | See AD-628179 |
| 65-2237 | 20-44402 | See AD-628065 |
| 66-0169 | 20-44403 | See AD-628143 |
| 66-0225 | 20-44163 | See AD-628528 |
| 66-1111 | 20-43882 | See AD-636487 |
| 66-1670 | 20-43885 | See ASRL-TR-132-2 |
| **AFRRI-TN–** | **(Non-AEC)** | |
| 66-2 | 20-42829 | See AD-635167 |
| **AFWL-TR–** | **(Non-AEC)** | |
| 65-1 | 20-44850 | See AD-628506 |
| 65-43 | 20-43495 | See AD-628806 |
| 66-78 | 20-44416 | See AD-639436 |
| **AGN–** | **(Misc.)** | |
| 8163(Vol.3) | 20-43797 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 8191(Vol.1) | 20-43884 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **AHSB(RP)–** | **(British)** | |
| R-70 | 20-43571 | Dep. BIS |
| **ALO–** | | |
| 3634-2 | 20-43798 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **AN-AGCR–** | | |
| 814 | 20-43838 | See TID-23319 |
| **ANL–** | | |
| 6236 | 20-43824 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 6964 | 20-45202 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 7127 | 20-43846 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 7136 | 20-42832 | Dep. mn. CFSTI $7.00 cy, $1.75 mn |
| 7137 | 20-43410 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 7142 | 20-43164 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 7218 | 20-44601 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 7249 | 20-45106 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| **AROD–** | **(Misc.)** | |
| 4832:7 | 20-44854 | See AD-630074 |
| **ASRL-TR–** | **(Non-AEC)** | |
| 132-2 | 20-43885 | |
| **ATD-B–** | **(Non-AEC)** | |
| 65-76 | 20-43666 | See AD-623557 |
| **BAW–** | **(Misc.)** | |
| 3460-2 | 20-45094 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **BBC–** | | |
| 111 | 20-43886 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **BDX–** | | |
| 613-85 | 20-43847 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **BLG–** | **(Belgian)** | |
| 337 | 20-43596 | Ann. Gembloux, 70: 215-23(1964) |
| **BM-RI–** | **(Misc.)** | |
| 6836 | 20-43165 | Bureau of Mines Free |
| **BMI–** | **(Misc.)** | |
| 1781 | 20-43166 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **BMI-X–** | | |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 10173 | 20-45045 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **BMwF-FBK–** | **(German)** | |
| 66-03 | 20-43012 | Dep. mn |
| 66-11 | 20-43167 | Dep. mn. DM 11,00 |
| **BNL–** | | |
| 957 | 20-45235 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 967 | 20-42704 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 982 | 20-44602 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 991 | 20-43808 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 9432 | 20-43608 | Health Phys., 12: 1317-25(1966) |
| 9533 | 20-45086 | Nucl. Sci. Eng., 26: 13-25(1966) |
| 9692 | 20-44057 | Nucl. Sci. Eng., 26: 117-21(1966) |
| 9718 | 20-44001 | Acta Met., 14: 1195-1200(1966) |
| 9949 | 20-43227 | J. Chem. Phys., 45: 2618-29(1966) |
| 9985 | 20-43300 | Chem. Eng. Progr., 62: No. 9, 105-16 (1966) |
| 10039 | 20-43651 | Nucl. Instrum. Methods, 44: 349-52(1966) |
| 10099 | 20-43278 | J. Amer. Chem. Soc., 88: 3775-81(1966) |
| 10179 | 20-44804 | Phys. Rev., 150: 146-51(1966) |
| 10194 | 20-43948 | J. Chem. Phys., 45: 2221-7(1966) |
| 10331 | 20-44076 | Astrophys. J., 145: 960-1(1966) |
| 10346 | 20-44521 | Phys. Lett., 22: 361-2(1966) |
| 10358 | 20-42843 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 10385 | 20-42844 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 10405 | 20-42705 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 10408 | 20-42784 | Schweiz. Med. Wochensch., 95: 1421-4 (1965) |
| 10544 | 20-44991 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 10569 | 20-43987 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 50003 | 20-43809 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **BNL-tr–** | | |
| 65 | 20-44664 | Dep. mn. JCL $1.60 fs, $0.80 mf |
| 84 | 20-43093 | Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.10 fs, $0.80 mf |
| **BNWL–** | | |
| 113-17 | 20-45236 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 113-18 | 20-45237 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 119 | 20-45108 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 140(Rev.1) | 20-43800 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| 231 | 20-43887 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 242 | 20-43825 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 269 | 20-43810 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 273(Vol.1&App.) | 20-43849 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 273(Vol.3) | 20-45095 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 282 | 20-45215 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 289 | 20-45096 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 290(Pt.1) | 20-43888 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **BNWL-SA–** | | |
| 420 | 20-44007 | Carbon, 4: 215-22(1966) |
| 674 | 20-43059 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 677 | 20-43411 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 782 | 20-43990 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 816 | 20-43572 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **CALT–** | | |
| 68-88 | 20-44264 | Phys. Rev. Lett., 17: 722-5(1966) |
| 68-91 | 20-44263 | Phys. Rev. Lett., 17: 720-2(1966) |
| 532-1 | 20-43288 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 532-2 | 20-43289 | Dep. mn. CFSTI $7.00 cy, $1.50 mn |
| 532-3 | 20-44109 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| **CAPE–** | | |
| 1432 | 20-43561 | EM |
| 1462 | 20-43663 | EM |
| 1477 | 20-43664 | EM |
| 1478 | 20-43750 | EM |
| **CEA-R–** | **(French)** | |
| 2967 | 20-43060 | Dep. mn |
| 2998 | 20-43061 | Dep. mn |
| 3008 | 20-44501 | Dep. mn |
| **CEX–** | | |
| 59.4.26 | 20-43513 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 59.7B(Pt.1) | 20-43496 | Dep. mn. CFSTI $1.50 cy, $0.75 mn |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **CONF-178–** | **(European Atomic Energy Society's Symposium on Fuel Cycles for Power Reactors, Baden-Baden, Germany, Sept. 1963)** | |
| 6 | 20-45180 | ORAU |
| 7 | 20-45100 | ORAU |
| 11 | 20-45185 | ORAU |
| **CONF-559–** | **20-45206** | **(Symposium on the Utilization of Research Reactors, Atlanta, Nov. 1963) See ORO-3191-1** |
| **CONF-629–** | **20-43665** | **(7th National Power Instrumentation Symposium, Denver, May 1964) ISA (Instr. Soc. Amer.), Proc., Nat. Power Instr. Symp., 7: 1-169(1964)** |
| **CONF-747–** | **(4th Symposium on Radioactivity in Scandinavia, Riso, Denmark, Oct. 5–6, 1964)** | |
| 8 | 20-42736 | ORAU |
| **CONF-765–** | **20-9170** | **(2nd Conference on Radioactive Fallout from Nuclear Weapons Tests, Germantown, Md., Nov. 3–6, 1964)** |
| 13 | 20-43573 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **CONF-640515–** | **20-44173** | **(International Conference of Combustion and Energy Conversion, Paris, France, May 20–23, 1964) Paris, Institut Francais des Combustibles et de l'Energie, 1964** |
| **CONF-640819–** | **(15th Proceedings Alaskan Science Conference, College, Alaska, Aug. 31–Sept. 4, 1964)** | |
| 1 | 20-42821 | pp 115-33 of Science in Alaska. Alaska Division of American Association for the Advancement of Science, 1965 |
| 2 | 20-43622 | pp 16-26 of Science in Alaska. Alaska Division of American Association for the Advancement of Science, 1965 |
| **CONF-650311–** | **(Conference on Analytical Chemistry and Applied Spectroscopy, Pittsburgh, Mar. 5, 1965)** | |
| 7 | 20-43157 | ORAU |
| **CONF-650405–** | **(International Conference on Modern Trends in Activation Analysis, College Station, Tex., Apr. 19–22, 1965)** | |
| 22 | 20-43160 | ORAU. Gmelin, AED-CONF-65-040-33 |
| **CONF-650410–** | **(American Physical Society, Washington, D. C., Apr. 26–29, 1965)** | |
| 49 | 20-44839 | ORAU. Gmelin, AED-CONF-65-073-101 |
| **CONF-650502–** | **(Electrochemical Society, San Francisco, May 9–14, 1965)** | |
| 5 | 20-43913 | See UCRL-16256 |
| **CONF-650519–** | **(13th Annual Conference of American Society of Testing Materials, St. Louis, May 16–21, 1965)** | |
| 11 | 20-43746 | ORAU. Gmelin, AED-CONF-65-120-44 |
| **CONF-650560–** | **(13th Annual Meeting of the Radiation Research Society, Philadelphia, May 23–26, 1965)** | |
| 12 | 20-42996 | ORAU. Gmelin, AED-CONF-65-157-24 |
| 14 | 20-42972 | ORAU |
| **CONF-650602–** | **(American Nuclear Society 11th Annual Meeting, Gatlinburg, Tenn., June 20–24, 1965)** | |
| 88 | 20-44590 | See WAPD-T-1802 |
| **CONF-650616–** | **(Health Physics Society, Annual Meeting, Los Angeles, June 14–17, 1965)** | |
| 21 | 20-42794 | ORAU. Gmelin, AED-CONF-65-153-41 |
| 22 | 20-43630 | ORAU. Gmelin, AED-CONF-65-153-34 |
| 29 | 20-43631 | ORAU. Gmelin, AED-CONF-65-153-50 |
| 31 | 20-43632 | ORAU |
| **CONF-650631–** | **20-43822** | **(International Powder Metallurgical Conference, New York, June 14–17, 1965) $22.50** |
| **CONF-650637–** | **(International Conference on Luminescent Dosimetry, Palo Alto, Calif., June 21–23, 1965)** | |
| 11 | 20-43747 | ORAU. Gmelin, AED-CONF-65-151-22 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| CONF-650647– | (Society of Nuclear Medicine, 12th Annual Meeting, Bal Harbour, Fla., June 19, 1965) | |
| 4 | 20-43049 | ORAU. Gmelin, AED-CONF-65-197-3 |
| CONF-650653– | (American Physical Society, Summer Meeting, New York, June 23–25, 1965) | |
| 29 | 20-44842 | ORAU. Gmelin, AED-CONF-66-060-103 |
| CONF-650654– | (Ocean Science and Engineering Conference, Washington, D. C., June 14–17, 1965) | |
| 2 | 20-43545 | ORAU. Gmelin, AED-CONF-65-167-5 |
| CONF-650706– | 20-34656 | (International Conference on the Study of Nuclear Structure with Neutrons, Antwerp, July 19–23, 1965) Amsterdam, North-Holland Publishing Company, 1966 |
| 26 | 20-44633 | See EUR-3053.e |
| CONF-650809– | (Society for Applied Spectroscopy, 4th National Meeting, Denver, Aug. 30–Sept. 3, 1965) | |
| 3 | 20-43156 | ORAU. Gmelin, AED-CONF-65-229-2 |
| CONF-650810– | 20-43267 | (Annual Conference on Applications of X-Ray Analysis, Denver, Aug. 25–27, 1965) Advances X-Ray Anal., 9: 1-544 (1966) |
| 5 | 20-43161 | ORAU. Gmelin, AED-CONF-65-212-11 |
| CONF-650902– | (American Chemical Society, 150th National Meeting, Atlantic City, Sept. 12–17, 1965) | |
| 21 | 20-42973 | ORAU. Gmelin, AED-CONF-65-235-35 |
| 23 | 20-43794 | ORAU. Gmelin, AED-CONF-65-235-3 |
| 32 | 20-43371 | ORAU. Gmelin, AED-CONF-65-235-73 |
| 33 | 20-43286 | ORAU. Gmelin, AED-CONF-65-235-72 |
| 34 | 20-42826 | ORAU. Gmelin, AED-CONF-65-235-71 |
| CONF-650951– | 20-45044 | (International Luminescence Symposium on the Physics and Chemistry of Scintillators, Munich, Sept. 4–10, 1965) DM 68.- |
| CONF-650978– | (3rd Symposium on the Plasma Sheath-Plasma Electromagnetics of Hypersonic Flight, Boston, Mass., Sept. 21–23, 1965) | |
| 1 | 20-44861 | See NASA-CR-596 |
| CONF-651004– | (9th Conference on Analytical Chemistry in Nuclear Technology, Gatlinburg, Tenn., Oct. 12, 1965) | |
| 12 | 20-43158 | |
| CONF-651015– | (American Physical Society Meeting, Chicago, Oct. 7, 1965) | |
| 25 | 20-44835 | ORAU. Gmelin, AED-CONF-1965-312-45 |
| CONF-651066– | (12th Ottawa Symposium on Applied Spectroscopy, Ottawa, Ontario, Canada, Oct. 18–20, 1965) | |
| 1 | 20-43155 | ORAU. Gmelin, AED-CONF-65-359-1 |
| CONF-651114– | (Annual Meeting of the Soil Science Society of America, Columbus, Ohio, Nov. 1–4, 1965) | |
| 3 | 20-43455 | ORAU. Gmelin, AED-CONF-65-342-3 |
| CONF-651132– | (Atomic Industrial Forum, 12th Annual Conference, Washington, D. C., Nov. 17, 1965) | |
| 8 | 20-45179 | ORAU. Gmelin, AED-CONF-65-337-30 |
| CONF-651139– | (Radiological Society of North America, 51st Annual Meeting, Chicago, Nov. 28–Dec. 3, 1965) | |
| 1 | 20-42797 | ORAU. Gmelin, AED-CONF-65-335-2 |
| 2 | 20-43050 | ORAU. Gmelin, AED-CONF-65-444-1 |
| CONF-651142– | (American Chemical Society, Western Regional Meeting, Los Angeles, Nov. 18–20, 1965) | |
| 1 | 20-43269 | ORAU. Gmelin, AED-CONF-65-358-1 |
| CONF-660107– | (American Physical Society Meeting, New York, Jan. 26–29, 1966) | |
| 63 | 20-44845 | ORAU. Gmelin, AED-CONF-66-003-151 |
| CONF-660110– | (Canadian Electrical Assn. Eastern Zone Meetings, Halifax, Nova Scotia, Jan. 24–27, 1966) | |
| 2 | 20-45184 | ORAU. Gmelin, AED-CONF-66-029-2 |
| CONF-660111– | (American Chemical Society, Winter Meeting, Phoenix, Ariz., Jan. 16–19, 1966) | |
| 1 | 20-43795 | ORAU. Gmelin, AED-CONF-66-001-3 |
| CONF-660115– | 20-43356 | (Nuclear and Radiation Chemistry Symposium, Waltair, India, Jan. 20–22, 1966) Bombay, Department of Atomic Energy, 1966 |
| CONF-660206– | (Symposium on Neutron Noise, Waves, and Pulse Propagation, Gainesville, Feb. 14–16, 1966) | |
| 16 | 20-45091 | ORAU. Gmelin, AED-CONF-66-014-18 |
| 17 | 20-45213 | ORAU. Gmelin, AED-CONF-66-014-16 |
| CONF-660208– | (Symposium on Solidification and Long-Term Storage of Highly Radioactive Wastes, Richland, Wash., Feb. 14–18, 1966) | |
| 18 | 20-45232 | ORAU. Gmelin, AED-CONF-66-019-10 |
| 19 | 20-45233 | ORAU. Gmelin, AED-CONF-66-019-15 |
| 20 | 20-45230 | ORAU. Gmelin, AED-CONF-66-019-18 |
| 21 | 20-45231 | ORAU. Gmelin, AED-CONF-66-019-27 |
| CONF-660210– | (American Institute of Chemical Engineers, 58th National Meeting, Dallas, Feb. 6–9, 1966) | |
| 2 | 20-43377 | ORAU. Gmelin, AED-CONF-66-006-4 |
| 3 | 20-43881 | ORAU. Gmelin, AED-CONF-66-006-5 |
| CONF-660212– | (Radiation Research Society. 14th Annual Meeting, Coronado, Calif., Feb. 13–16, 1966) | |
| 2 | 20-43035 | Nature, 211: 996-7(1966) |
| 4 | 20-42971 | ORAU. Gmelin, AED-CONF-66-016-3 |
| 5 | 20-42975 | ORAU. Gmelin, AED-CONF-66-016-4 |
| 7 | 20-42974 | ORAU. Gmelin, AED-CONF-66-016-7 |
| CONF-660214– | (American Chemical Society, 1st Middle Atlantic Regional Meeting, Philadelphia, Feb. 3–4, 1966) | |
| 2 | 20-43162 | ORAU. Gmelin, AED-CONF-66-039-2 |
| CONF-660303– | 20-44603 | (American Physical Society, Conference of Neutron Cross Section Technology, Washington, D. C., Mar. 22–24, 1966) Dep. mn. CFSTI $11.25 cy, $4.25 mn |
| 36 | 20-45092 | ORAU. Gmelin, AED-CONF-66-034-22 |
| 42 | 20-43745 | ORAU. Gmelin, AED-CONF-66-034-11 |
| CONF-660305– | (American Nuclear Society, Topical Meeting, Augusta, Ga., Mar. 21–23, 1966) | |
| 21 | 20-43792 | ORAU. Gmelin, AED-CONF-66-038-7 |
| 22 | 20-43803 | ORAU. Gmelin, AED-CONF-66-038-4 |
| CONF-660306– | (American Physical Society, Conference on Isobaric Spin, Tallahassee, Mar. 17–19, 1966) | |
| 13 | 20-44837 | ORAU. Gmelin, AED-CONF-66-048-10 |
| 15 | 20-44834 | ORAU. Gmelin, AED-CONF-66-048-13 |
| 16 | 20-44841 | ORAU. Gmelin, AED-CONF-66-048-17 |
| 17 | 20-44844 | ORAU. Gmelin, AED-CONF-66-048-20 |
| CONF-660320– | (American Chemical Society, 151st Meeting, Pittsburgh, Mar. 22–31, 1966) | |
| 4 | 20-43370 | ORAU. Gmelin, AED-CONF-66-051-5 |
| 5 | 20-43287 | ORAU. Gmelin, AED-CONF-66-051-6 |
| 6 | 20-43268 | ORAU. Gmelin, AED-CONF-66-051-12 |
| 7 | 20-43375 | ORAU. Gmelin, AED-CONF-66-051-1 |
| 8 | 20-43374 | ORAU. Gmelin, AED-CONF-66-051-25 |
| 9 | 20-43372 | ORAU. Gmelin, AED-CONF-66-051-23 |
| 10 | 20-45226 | ORAU. Gmelin, AED-CONF-66-051-21 |
| 11 | 20-43369 | ORAU. Gmelin, AED-CONF-66-051-32 |
| 12 | 20-43378 | ORAU. Gmelin, AED-CONF-66-051-36 |
| 14 | 20-43376 | ORAU. Gmelin, AED-CONF-66-051-50 |
| CONF-660329– | (Geology of Industrial Minerals, 2nd Annual Midwest Forum, Bloomington, Ind., Mar. 31–Apr. 1, 1966) | |
| 1 | 20-43514 | See UCRL-16878 |
| CONF-660332– | (Conference on Ultraviolet and X-Ray Spectroscopy of Laboratory and Astrophysical Plasmas, Culham, England, Mar. 29–Apr. 1, 1966) | |
| 1 | 20-44871 | Dep. mn. CFSTI $1.00 cy, $0.50 mn.<br>JCL $1.10 fs, $0.80 mf |
| CONF-660401– | (American Meteorological Society, American Geophysical | |

| Report No. | Abstract No. | Availability |
|---|---|---|
|  | Union, Annual Joint Meeting, Washington, D. C., Apr. 19, 1966) |  |
| 4 | 20-43543 | ORAU. Gmelin, AED-CONF-66-061-13 |
| CONF-660411– | (American Physical Society Meeting, Washington, D. C., Apr. 25–28, 1966) |  |
| 8 | 20-44843 | ORAU. Gmelin, AED-CONF-66-060-32 |
| 46 | 20-44840 | ORAU. Gmelin, AED-CONF-66-060-95 |
| CONF-660419– | (IEEE Region 6 Annual Conference, Tucson, Ariz., Apr. 26–28, 1966) |  |
| 1 | 20-43368 | ORAU. Gmelin, AED-CONF-66-057-1 |
| CONF-660427– | (4th Symposium on Remote Sensing of Environment, Ann Arbor, Mich., Apr. 12–14, 1966) |  |
| 1 | 20-43542 | ORAU. Gmelin, AED-CONF-66-076-1 |
| CONF-660429– | (American Power Conference, 28th Annual Meeting, Chicago, Ill., Apr. 26–28, 1966) |  |
| 2 | 20-45178 | ORAU. Gmelin, AED-CONF-66-098-10 |
| 4 | 20-45189 | ORAU. Gmelin, AED-CONF-66-098-5 |
| CONF-660430– | (Ohio Academy of Science, 75th Annual Meeting, Columbus, Ohio, Apr. 21–23, 1966) |  |
| 1 | 20-44836 | ORAU. Gmelin, AED-CONF-66-105-1 |
| CONF-660431– | (Symposium on Hot Atom Chemistry, Lafayette, Ind., Apr. 1–2, 1966) |  |
| 2 | 20-43408 | ORAU |
| 3 | 20-43373 | ORAU. Gmelin, AED-CONF-66-120-3 |
| 5 | 20-43291 | See IA-1096 |
| CONF-660433– | (American Radium Society, 48th Annual Meeting, Phoenix, Ariz., Apr. 13–16, 1966) |  |
| 4 | 20-42976 | ORAU. Gmelin, AED-CONF-66-064-5 |
| CONF-660445– | (Symposium on Recent Advances in Cosmic Ray Research, Huntington Beach, Calif., Apr. 3–7, 1966) |  |
| 1 | 20-44417 | See LA-DC-7837 |
| CONF-660503– | (7th Japanese Conference on Radioisotopes, Tokyo, May 16–19, 1966) |  |
| 4 | 20-43292 | See ORO-2968-21 |
| CONF-660507– | (Symposium for the Disposal of Radioactive Wastes into Sea, Oceans, and Surface Waters, Vienna, May 17, 1966) |  |
| 6 | 20-45223 | ORAU |
| 7 | 20-43544 | ORAU |
| 8 | 20-45225 | ORAU |
| 10 | 20-45224 | ORAU |
| 11 | 20-45228 | ORAU |
| 13 | 20-45227 | ORAU |
| 14 | 20-43539 | ORAU |
| 15 | 20-43540 | ORAU |
| 16 | 20-43541 | ORAU |
| 29 | 20-45229 | ORAU |
| CONF-660511– | (International Symposium on Capsule Irradiation Experiments, Pleasanton, Calif., May 3–5, 1966) |  |
| 10 | 20-43996 | See LA-DC-7772 |
| CONF-660516– | (Annual Conference on Organic and Heavy Water Reactors, Winnipeg, Canada, May 30–June 1, 1966) |  |
| 4 | 20-45177 | ORAU. Gmelin, AED-CONF-66-138-3 |
| 7 | 20-45102 | See 66-CNA-320 |
| 12 | 20-45101 | See 66-CNA-305 |
| 13 | 20-45183 | ORAU |
| 17 | 20-45245 | ORAU. Gmelin, AED-CONF-66-138-9 |
| CONF-660518– | (AEC Annual Metallography Meeting, Denver, May 18–20, 1966) |  |
| 8 | 20-43906 | See ORNL-P-2361 |
| CONF-660523– | (21st Annual Purdue Industrial Waste Conference, Lafayette, Ind., May 3–5, 1966) |  |
| 3 | 20-45222 | ORAU. Gmelin, AED-CONF-66-182-1 |
| CONF-660524– | (2nd International Thorium Fuel Cycle Symposium, Gatlinburg, Tenn., May 3–6, 1966) |  |
| 7 | 20-45176 | ORAU. Gmelin, AED-CONF-66-104-7 |
| 12 | 20-43860 | See SGAE-CH-35/1966 |
| 14 | 20-45096 | See BNWL-289 |
| 15 | 20-43850 | Dep. mn. CFSTI $1.00 cy, $0.50 mn. ORAU. Gmelin, AED-CONF-66-104-8 |
| 17 | 20-45105 | See AEET-252 |
| 19 | 20-43415 | See ISO-SA-3(Rev.) |
| CONF-660538– | (American Public Health Assn. Meeting, Las Vegas, Nev., May 23–25, 1966) |  |
| 1 | 20-43574 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| CONF-660539– | (American Society for Microbiology, 66th Annual Meeting, Los Angeles, Calif., May 1–5, 1966) |  |
| 2 | 20-43793 | ORAU. Gmelin, AED-CONF-66-114-2 |
| CONF-660543– | (Conference on Effects of Various Types of Ionizing Radiations from Different Sources on the Haematopoietic Tissue, Vienna, Austria, May 17–20, 1966) |  |
| 1 | 20-42845 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2 | 20-42844 | See BNL-10385 |
| 3 | 20-42705 | See BNL-10405 |
| CONF-660546– | (American Society of Civil Engineers, Water Resources Engineering Conference, Denver, Colo., May 16–20, 1966) |  |
| 2 | 20-45188 | ORAU. Gmelin, AED-CONF-66-111-3 |
| CONF-660551– | (7th Semiannual Meeting of the Plutonium Weapons Information, Livermore, Calif., May 17–18, 1966) |  |
| 1 | 20-43895 | See LA-DC-7934 |
| CONF-660606– | 20-34872 | (American Nuclear Society Meeting, Denver, June 19–23, 1966) Trans. Amer. Nucl. Soc., 9: 1-322(1966) |
| 19 | 20-45191 | See RL-GEN-1058 |
| 39 | 20-43889 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| CONF-660608– | (2nd AIAA Propulsion Joint Specialist Conference, Colorado Springs, June 13–17, 1966) |  |
| 8 | 20-45199 | ORAU |
| 10 | 20-45200 | ORAU |
| CONF-660609– | (International Symposium on Food Irradiation Meeting, Karlsruhe, Germany, June 6–10, 1966) |  |
| 8 | 20-43791 | ORAU |
| CONF-660611– | (Society of Applied Spectroscopy Meeting, Chicago, June 14–15, 1966) |  |
| 6 | 20-43159 | ORAU. Gmelin, AED-CONF-66-172-4 |
| 7 | 20-43154 | ORAU. Gmelin, AED-CONF-66-172-9 |
| CONF-660614– | (3rd International Congress on Radiation Research, Cortina, Italy, June 1966) |  |
| 4 | 20-43290 | See COO-1528-7 |
| CONF-660621– | (Health Physics Society, 11th Annual Meeting, Houston, Tex., June 27–30, 1966) |  |
| 1 | 20-43575 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7 | 20-43576 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| CONF-660627– | (American Society for Testing and Materials, 69th Annual Meeting, Atlantic City, N. J., June 27–July 1, 1966) |  |
| 1 | 20-43999 | See ORNL-TM-1544 |
| CONF-660632– | (American Inst. of Aeronautics and Astronautics, 4th Aerospace Sciences Meeting, Los Angeles, Calif., June 27–29, 1966) |  |
| 4 | 20-45201 | ORAU |
| CONF-660633– | (American Physical Society, Division of Plasma Physics, Minneapolis, Minn., June 1966) |  |
| 11 | 20-44864 | See ORNL-4010 |
| CONF-660637– | (Conference on Precision Electromagnetic Measurements, Boulder, Colo., June 21–24, 1966) |  |
| 1 | 20-43634 | See SLAC-PUB-199 |
| CONF-660705– | (IEEE Annual Conference, Palo Alto, Calif., July 18–22, 1966) |  |
| 2(Rev.) | 20-43755 | See SC-DC-66-1821 |
| CONF-660708– | (Institute of Electrical and Electronics Engineers, |  |

| Report No. | Abstract No. | Availability |
|---|---|---|
| | Summer Meeting, New Orleans, La., July 10–15, 1966) | |
| 2 | 20-45182 | ORAU |
| 5 | 20-45181 | ORAU |
| CONF-660710– | (Cooperative International Neutron Seed Irradiation Program Meeting, Vienna, Austria, July 1966) | |
| 1 | 20-42843 | See BNL-10358 |
| CONF-660717– | (International Symposium on Experimental and Theoretical Aspects of Toroidal Confinement, Princeton, N. J., July 11–15, 1966) | |
| 1 | 20-44873 | For translation see MATT-Trans-35 |
| 2 | 20-44874 | For translation see MATT-Trans-36 |
| 3 | 20-44875 | For translation see MATT-Trans-37 |
| CONF-660805– | (International Conference on Solvent Extraction, Goteborg, Sweden, Aug. 27–Sept. 1, 1966) | |
| 3 | 20-43423 | See ORNL-P-2354 |
| 4 | 20-43424 | See ORNL-P-2359 |
| CONF-660806– | (Electron Microscope Society of America, 24th Annual Meeting, San Francisco, Calif., Aug. 22–25, 1966) | |
| 1 | 20-43990 | See BNWL-SA-782 |
| CONF-660807– | (Symposium on Neutron Monitoring for Radiological Protection, Vienna, Austria, Aug. 29, 1966) | |
| 4 | 20-43671 | See ORNL-P-2467 |
| 5 | 20-43672 | See ORNL-P-2471 |
| 6 | 20-43673 | See PPAD-596-E |
| CONF-660813– | (American Meeting of the Royal Microscopical Society, Chicago, Ill., Aug. 15–19, 1966) | |
| 1 | 20-43181 | See ORNL-P-2439 |
| CONF-660814– | (15th Annual Conference on Applications of X-Ray Analysis, Denver, Colo., Aug. 10–12, 1966) | |
| 1 | 20-43890 | See COO-1198-385 |
| CONF-660815– | (Conference on Principles of Radiation Protection, Oak Ridge, Tenn., Aug. 24–26, 1966) | |
| 1 | 20-43572 | See BNWL-SA-816 |
| CONF-660816– | (10th International Conference on Low Temperature Physics, Moscow, U.S.S.R., Aug. 31–Sept. 6, 1966) | |
| 1 | 20-44503 | See LA-DC-8165 |
| 3 | 20-44504 | See UCRL-17026 |
| CONF-660817– | (International Symposium on Why and How Should We Investigate Nuclides Far Off the Stability Line, Lysekil, Sweden, Aug. 21–27, 1966) | |
| 2 | 20-43419 | See LA-DC-7869 |
| 4 | 20-44070 | See LA-DC-7885 |
| CONF-660818– | (International Conference on Luminescence, Budapest, Hungary, Aug. 23–30, 1966) | |
| 1 | 20-44994 | See NYO-3464-2 |
| CONF-660904– | (9th Air Cleaning Conference, Boston, Mass., Sept. 13–16, 1966) | |
| 7 | 20-45049 | See ORNL-P-2431 |
| 9 | 20-43583 | See ORNL-P-2387 |
| 11 | 20-43584 | See ORNL-P-2411 |
| CONF-660906– | (International Conference on Nuclear Physics, Gatlinburg, Tenn., Sept. 12–17, 1966) | |
| 4 | 20-44838 | ORAU |
| 15 | 20-44662 | See USC-136-111 |
| 16 | 20-44660 | See UCRL-70002 |
| 17 | 20-44658 | See UCRL-16984 |
| 19 | 20-44651 | See ORNL-P-2434 |
| 21 | 20-44650 | See ORNL-P-2412 |
| 25 | 20-44652 | See ORNL-P-2468 |
| 32 | 20-44659 | See UCRL-16990 |
| CONF-660907– | (American Chemical Society Meeting, New York, Sept. 11–16, 1966) | |
| 3 | 20-43411 | See BNWL-SA-677 |
| CONF-660917– | (Gastrointestinal Radiation Injury Symposium, Richland, Washington, Sept. 25–28, 1966) | |
| 4 | 20-42740 | See LA-DC-7764 |
| CONF-660919– | (Conference on Applications of Thermoluminescence to | |

| Report No. | Abstract No. | Availability |
|---|---|---|
| | Geological Problems, Spoleto, Italy, Sept. 5–16, 1966) | |
| 3 | 20-43987 | See BNL-10569 |
| CONF-660921– | (International Colloquium on Intense Magnetic Fields, Their Production and Their Application, Grenoble, France, Sept. 12–14, 1966) | |
| 2 | 20-44030 | See ORNL-P-2492 |
| CONF-660923– | (Solid State Conference on Interaction of Radiation With Solids, Cairo, Egypt, Sept. 3–7, 1966) | |
| 2 | 20-44991 | See BNL-10544 |
| CONF-660924– | (International Conference on Magnetic Resonance and Relaxation, 14th Colloque AMPERE, Ljubljana, Yugoslavia, Sept. 6–11, 1966) | |
| 2 | 20-43171 | See LA-DC-7394(Rev.) |
| CONF-660925– | (Seminar on Intense Neutron Sources, Santa Fe, N. Mex., Sept. 19–23, 1966) | |
| 1 | 20-45205 | See ORNL-P-2491 |
| CONF-660927– | (International Society of Rock Mechanics, 1st International Congress, Lisbon, Portugal, Sept. 25–Oct. 1, 1966) | |
| 1 | 20-45217 | See ORNL-P-2126 |
| CONF-661001– | (14th Conference on Remote Systems and Technology, Pittsburgh, Oct. 30–Nov. 4, 1966) | |
| 4 | 20-43669 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 13 | 20-43416 | See ISO-SA-24 |
| 14 | 20-43466 | See DP-MS-66-16 |
| 16 | 20-43417 | See ISO-SA-25 |
| 17 | 20-43081 | See ORO-2980-13 |
| 18 | 20-45048 | See ORNL-P-2311 |
| 19 | 20-43425 | See ORNL-P-2406 |
| 23 | 20-45204 | See ORNL-P-2410 |
| CONF-661003– | (AIME Nuclear Metallurgy Symposium on High Temperature Nuclear Fuels, Delevan, Wis., Oct. 3–5, 1966) | |
| 1 | 20-43814 | See LA-DC-7581 |
| 6 | 20-43855 | See LA-DC-6954 |
| CONF-661004– | (Instrument Society of America, Fall Meeting, New York, Oct. 1966) | |
| 1 | 20-43635 | See UCRL-12484(Rev.2) |
| CONF-661008– | (1st Materials Research Symposium on Trace Characterization—Chemical and Physical, Gaithersburg, Md., Oct. 3–7, 1966) | |
| 2 | 20-43091 | See UCRL-14879 |
| 3 | 20-43059 | See BNWL-SA-674 |
| CONF-661011– | (AEC Contractors' Nuclear Materials Management Meeting, Berkeley, Calif., Oct. 3–5, 1966) | |
| 1 | 20-43062 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 3 | 20-43065 | See GAT-T-1403 |
| CONF-661012– | (IAEA Symposium on the Standardization of Radionuclides, Vienna, Austria, Oct. 10–14, 1966) | |
| 1 | 20-43380 | See ORNL-P-2432 |
| 2 | 20-43381 | See ORNL-P-2433 |
| 3 | 20-43074 | See LA-DC-7831 |
| CONF-661013– | (6th Conference on Thermal Conductivity, Wright-Patterson AFB, Ohio, Oct. 1966) | |
| 1 | 20-43896 | See LA-DC-8163 |
| CONF-661016– | (Symposium on Engineering Problems of Controlled Thermonuclear Research, Gatlinburg, Tenn., Oct. 3–6, 1966) | |
| 1 | 20-44867 | See UCRL-70026 |
| 2 | 20-44866 | See UCRL-70025 |
| 8 | 20-44868 | See UCRL-70027 |
| 15 | 20-43638 | See UCRL-70018 |
| CONF-661101– | (American Society of Metallurgists Meeting, Cleveland, Ohio, Nov. 12, 1966) | |
| 1 | 20-43915 | See UCRL-16761 |
| CONF-661102– | (American Society of Mechanical Engineers, Winter Annual Conference, New York, Nov. 27, 1966) | |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 1 | 20-43477 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 3 | 20-43636 | See UCRL-14993 |
| 4 | 20-43909 | See SC-DC-66-1888 |
| 5 | 20-43491 | See ORNL-P-2472 |
| **CONF-661104–** | **(14th Conference on Remote Systems and Technology, Washington, D. C., Nov. 15–18, 1966)** | |
| 1 | 20-43470 | See UCRL-14743 |
| **COO–** | | |
| 7-0396 | 20-44739 | Nucl. Phys., 88: 689-96(1966) |
| 38-454 | 20-43319 | J. Phys. Chem., 70: 2919-25(1966) |
| 38-466 | 20-43313 | J. Amer. Chem. Soc., 88: 3683-9(1966) |
| 38-467 | 20-43314 | J. Amer. Chem. Soc., 88: 3689-94(1966) |
| 689-59 | 20-43502 | See COO-689-60,App.A-2 |
| 689-60 | 20-43500 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 689-60, App.A-1 | 20-43501 | |
| 689-60, App.A-2 | 20-43502 | |
| 689-60, App.A-3 | 20-43503 | |
| 689-60, App.A-4 | 20-43504 | |
| 689-60, App.A-5 | 20-43505 | |
| 689-60, App.A-6 | 20-43506 | |
| 689-60, App.A-7 | 20-43507 | |
| 689-61 | 20-43501 | See COO-689-60, App.A-1 |
| 689-62 | 20-43503 | See COO-689-60, App.A-3 |
| 689-63 | 20-43504 | See COO-689-60, App.A-4 |
| 689-64 | 20-43505 | See COO-689-60, App.A-5 |
| 689-65 | 20-43506 | See COO-689-60, App.A-6 |
| 689-66 | 20-43507 | See COO-689-60, App.A-7 |
| 818-80 | 20-43734 | Rev. Sci. Instrum., 37: 1340-4(1966) |
| 818-89 | 20-44947 | Phys. Rev. Lett., 17: 733-6(1966) |
| 1109-20 | 20-43967 | Phil. Trans. Roy. Soc. London, Ser. A, 259: 583-614(1966) |
| 1122-3 | 20-43813 | Dep. mn. CFSTI $4.00 cy, $1.00 mn |
| 1198-365 | 20-43732 | Rev. Sci. Instrum., 37: 1310-15(1966) |
| 1198-382 | 20-44502 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 1198-385 | 20-43890 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1233-28 | 20-44956 | Rev. Sci. Instrum., 37: 1308-10(1966) |
| 1339-3 | 20-42739 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1420-118 | 20-44845 | See CONF-660107-63 |
| 1528-7 | 20-43290 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **CTO–** | **(Non-AEC)** | |
| 282 | 20-44871 | For translation see CONF-660332-1 |
| **DASA–** | **(Misc.)** | |
| 1778 | 20-42710 | See TID-23348 |
| **DP–** | | |
| 670 | 20-45190 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1044 | 20-43412 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1045 | 20-45203 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1065 | 20-43168 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **DP-MS–** | | |
| 66-16 | 20-43466 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **DPST–** | | |
| 66-30-2 | 20-43577 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **DR–** | **(Misc.)** | |
| 19 | 20-45103 | See AECL-2590 |
| **DUBNA REPORTS** | | **(Russian)** |
| See JINR (Russian) | | |
| **ECOM–** | **(Non-AEC)** | |
| 01313-4 | 20-43753 | See AD-636773 |
| **EDI–** | **(Canadian)** | |
| 67(Rev.) | 20-43823 | See AECL-2566 |
| **EGG–** | | |
| 1183-2046 | 20-43754 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 1183-2096 | 20-43991 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **ESD-TR–** | **(Non-AEC)** | |
| 65-402 | 20-44851 | See AD-628777 |
| **ETR–** | **(Belgian)** | |
| 179 | 20-43077 | See NP-16214 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 193 | 20-43421 | See NP-16216 |
| **EUR–** | **(European Atomic Energy Community)** | |
| 2833 | 20-43478 | See EURAEC-1620 |
| 2852 | 20-43413 | See EURAEC-1659 |
| 2859 | 20-43992 | See EURAEC-1667 |
| 2863 | 20-43851 | See EURAEC-1671 |
| 2864 | 20-45109 | See EURAEC-1673 |
| 2872 | 20-43852 | See EURAEC-1685 |
| 2873 | 20-43891 | See EURAEC-1686 |
| 2878 | 20-43993 | See EURAEC-1691 |
| 2990.f | 20-43063 | Dep. mn |
| 2991.f | 20-43064 | Dep. mn |
| 2992.f | 20-42998 | Dep. mn |
| 3053.e | 20-44633 | Dep. mn |
| **EURAEC–** | | |
| 1620 | 20-43478 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 1659 | 20-43413 | Dep. mn. CFSTI $2.00 cy, $0.75 mn |
| 1667 | 20-43992 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1671 | 20-43851 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1673 | 20-45109 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1685 | 20-43852 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1686 | 20-43891 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1691 | 20-43993 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1707 | 20-43892 | See IITRI-578-P27-20 |
| 1708 | 20-45045 | See BMI-X-10173 |
| **EURFNR–** | **(Misc.)** | |
| 76F | 20-45207 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 96F | 20-43865 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **FR–** | **(Non-AEC)** | |
| 66-17-186 | 20-43752 | See AD-635583 |
| **FTD-MT–** | **(Non-AEC)** | |
| 64-180 | 20-44044 | For translation see AD-637068 |
| **FTD-TT–** | **(Non-AEC)** | |
| 65-420 | 20-43293 | For translation see AD-633448 |
| **FZK–** | **(Non-AEC)** | |
| 290 | 20-43994 | |
| **GA–** | **(Misc.)** | |
| 6506 | 20-43930 | Carbon, 4: 263-72(1966) |
| 6927 | 20-44009 | Carbon, 4: 293-5(1966) |
| **GAT-T–** | | |
| 1403 | 20-43065 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **GEAP–** | **(Misc.)** | |
| 4793 | 20-45110 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 4830 | 20-43826 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 5008 | 20-43853 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **GEMP–** | **(Misc.)** | |
| 424 | 20-45072 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **GTR–** | | |
| 19 | 20-43827 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| **HPR–** | **(Norwegian)** | |
| 68 | 20-45111 | |
| **HW–** | | |
| 59541 | 20-43578 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 66431 | 20-43854 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 66911 | 20-43828 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **IA–** | **(Non-AEC)** | |
| 1096 | 20-43291 | Dep. mn |
| **IAE–** | **(Non-AEC)** | |
| 1066 | 20-43271 | Dep. mn |
| 1078 | 20-44855 | Dep. mn |
| 1150 | 20-44028 | Dep. mn |
| 1152 | 20-44856 | Dep. mn |
| 1153 | 20-44857 | Dep. mn |
| **IAEA–** | **(International Atomic Energy Agency)** | |
| 2466-13 | 20-42846 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **IBJ–** | **(Polish)** | |
| See INR | | |
| **IDO–** | | |
| 14679 | 20-43066 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| 17168 | 20-45112 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 17188 | 20-44634 | Dep. mn. CFSTI $4.00 cy, $1.00 mn |
| 17192 | 20-45046 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **IEA–** | **(Brazilian)** | |
| 89 | 20-43871 | Met. ABM (Ass. Brasil. Metais), 21: 147-52(1965) |
| 92 | 20-43872 | Met. ABM (Ass. Brasil. Metais), 21: 217-22(1965) |
| **IFJ–** | **(Polish)** | |
| See INP | | |
| **IITRI–** | **(Misc.)** | |
| 578-P27-20 | 20-43892 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| B6035-20 | 20-43892 | See IITRI-578-P27-20 |
| **IN–** | | |
| 1012 | 20-44635 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **INDSWG–** | **(Russian)** | |
| 101 | 20-44665 | Dep. mn. JCL $15.50 fs, $7.22 mf |
| **INP–** | **(Polish)** | |
| 479/PL | 20-44636 | Dep. |
| **INR–** | **(Non-AEC)** | |
| 627/IA/PL | 20-44637 | Dep. |
| 659/IXA/RP | 20-45073 | Dep. |
| 693/I/PL | 20-43670 | Dep. |
| 725/XXII/C | 20-43579 | CFSTI $3.00 |
| **IPP–** | **(Non-AEC)** | |
| 1/49 | 20-43169 | Dep. mn |
| 1/50 | 20-44110 | Dep. mn |
| 3/39 | 20-44164 | Dep. mn |
| 3/41 | 20-44165 | Dep. mn |
| 6/48 | 20-44858 | Dep. mn |
| 6/53 | 20-44859 | Dep. mn |
| **IPPJ–** | **(Japanese)** | |
| 44(J) | 20-44069 | Dep. mn |
| **IPST-Cat.–** | **(Russian)** | |
| 1506 | 20-43639 | For translation see AEC-tr-6633 |
| 1699 | 20-43593 | For translation see AEC-tr-6642 |
| **IS–** | | |
| 1339 | 20-43234 | J. Phys. Chem., 70: 2980-4(1966) |
| 1378 | 20-43100 | Anal. Chem., 38: 1524-8(1966) |
| **IS-T–** | | |
| 95 | 20-44480 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 99 | 20-44029 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 107 | 20-43170 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 108 | 20-44992 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **ISO–** | | |
| 207 | 20-43414 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **ISO-SA–** | | |
| 3(Rev.) | 20-43415 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 24 | 20-43416 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 25 | 20-43417 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **J&M–** | | |
| 636A | 20-45242 | See TID-22978(Rev.) |
| **JAERI–** | **(Japanese)** | |
| 1107 | 20-45074 | |
| 1108 | 20-43479 | Dep. mn |
| 1109 | 20-45075 | Dep. mn |
| 4037 | 20-43995 | Dep. mn |
| **JINR–** | **(Russian)** | |
| E-2772 | 20-44638 | Dep. mn |
| P-2729 | 20-44639 | Dep. mn |
| P-2793 | 20-44640 | Dep. mn |
| P-2796 | 20-44641 | Dep. mn |
| P-2804 | 20-43073 | Dep. mn |
| P-2808 | 20-44642 | Dep. mn |
| P-2819 | 20-44643 | Dep. mn |
| **JNPC-MWP–** | **(British)** | |
| GSG/P(65)79 | 20-44020 | See TRG-Report-996 |
| GSG/P(65)90 | 20-44018 | See TRG-Report-1104 |
| **JPRS–** | **(Non-AEC)** | |
| 36718 | 20-43817 | CFSTI $2.00 cy, $0.50 mn |
| 36943 | 20-43056 | CFSTI $7.50 cy, $2.00 mn |
| **JUL–** | **(German)** | |
| 352-PP | 20-44860 | Dep. mn |
| **K–** | | |
| 1632(Pt.1) | 20-43633 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 1675 | 20-45238 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| **K-DP–** | | |
| 1637 | 20-45076 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **K-L–** | | |
| 6095 | 20-43101 | Anal. Chem., 38: 1570-3(1966) |
| **KAPL–** | | |
| 3119 | 20-43893 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 3146 | 20-43894 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **KFK-tr–** | **(German)** | |
| 201 | 20-45218 | Dep. mn. JCL $1.60 fs, $0.80 mf |
| **LA–** | | |
| 3534 | 20-43418 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 3543 | 20-43480 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 3546 | 20-43804 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 3582 | 20-43829 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **LA-DC–** | | |
| 6954 | 20-43855 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7394(Rev.) | 20-43171 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7566 | 20-45011 | J. Less-Common Metals, 11: 301-7(1966) |
| 7573 | 20-44708 | J. Nucl. Energy: Pts. A and B, 20: 588-90(1966) |
| 7581 | 20-43814 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 7585 | 20-43618 | Nucl. Sci. Eng., 26: 110-16(1966) |
| 7646(Rev.) | 20-44508 | Cryogenics, 6: 213-15(1966) |
| 7764 | 20-42740 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 7772 | 20-43996 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7783 | 20-43233 | J. Phys. Chem., 70: 2932-4(1966) |
| 7831 | 20-43074 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7837 | 20-44417 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 7869 | 20-43419 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7885 | 20-44070 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 7931 | 20-43075 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7934 | 20-43895 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 7973 | 20-44452 | J. Geophys. Res., 71: 4605-16(1966) |
| 8144 | 20-44041 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 8163 | 20-43896 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 8165 | 20-44503 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **LA-tr–** | | |
| 66-34 | 20-44672 | Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.10 fs, $0.80 mf |
| 66-36 | 20-44673 | Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.60 fs, $0.80 mf |
| 66-58 | 20-44872 | Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.60 fs, $0.80 mf |
| **LNF–** | **(Italian)** | |
| 66/31 | 20-44176 | Dep. mn |
| 66/32 | 20-44644 | Dep. mn |
| **M–** | **(Misc.)** | |
| 67-1-1 | 20-43883 | See AD-637777 |
| 418 | 20-43992 | See EURAEC-1667 |
| **MATT–** | | |
| 384 | 20-44915 | J. Math. Phys. (N. Y.), 7: 1507-31(1966) |
| 390 | 20-44907 | J. Appl. Phys., 37: 3775-8(1966) |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 426 | 20-44911 | J. Chem. Phys., 45: 2233-9(1966) |
| **MATT-Trans–** | | |
| 35 | 20-44873 | Dep. mn. CFSTI $2.00 cy, $0.50 mn. JCL $2.60 fs, $0.86 mf |
| 36 | 20-44874 | Dep. mn. CFSTI $2.00 cy, $0.50 mn. JCL $3.60 fs, $1.25 mf |
| 37 | 20-44875 | Dep. mn. CFSTI $2.00 cy, $0.50 mn. JCL $2.60 fs, $1.07 mf |
| **MCW–** | | |
| 1508 | 20-43420 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **MIT–** | **(Misc.)** | |
| 2098-219 | 20-44316 | J. Math. Phys. (N. Y.), 7: 1351-61(1966) |
| 2344-5 | 20-45077 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| 2344-6 | 20-45078 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| **MITNE–** | **(Misc.)** | |
| 67 | 20-45077 | See MIT-2344-5 |
| 69 | 20-45078 | See MIT-2344-6 |
| **MSAR–** | **(Misc.)** | |
| 66-174 | 20-43897 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **MTI–** | **(Misc.)** | |
| 65TR47 | 20-43469 | See TID-23350 |
| 66TR44 | 20-43481 | See NYO-3237-6 |
| **MURA–** | **(Misc.)** | |
| 719 | 20-44042 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **N–** | **(Misc.)** | |
| 66-11853 | 20-43666 | See AD-623557 |
| **NAA-SR–** | | |
| 11440 | 20-45113 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 11706 | 20-44645 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 11924 | 20-45194 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 11963 | 20-44582 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 11973 | 20-44646 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 11980(Vol.1) | 20-44583 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 11980(Vol.3) | 20-44584 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 12041 | 20-45047 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **NAA-SR-Memo–** | | |
| 11819 | 20-45195 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 11866 | 20-44585 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 11894 | 20-45196 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| 11901 | 20-43580 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 11966 | 20-43172 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 11967 | 20-43898 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 11971 | 20-45197 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 11977 | 20-45198 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 12006 | 20-43173 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 12019 | 20-44586 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **NAS-NS–** | **(Misc.)** | |
| 3058 | 20-43076 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| **NASA-CR–** | **(Misc.)** | |
| 596 | 20-44861 | CFSTI $2.50 cy, $0.75 mn |
| 608 | 20-43174 | CFSTI $2.00 cy, $0.50 mn |
| 54356 | 20-43815 | |
| 72019 | 20-45097 | See WCAP-2972 |
| 72029 | 20-43830 | |
| 72057 | 20-43831 | |
| 72058 | 20-43816 | See PWA-2877 |
| **NASA-TM–** | **(Misc.)** | |
| X-1287 | 20-44988 | CFSTI $1.00 cy, $0.50 mn |
| X-1294 | 20-44862 | CFSTI $1.00 cy, $0.50 mn |
| X-53453(Vol.2) | 20-43856 | |
| X-53453(Vol.4) | 20-43857 | |
| X-53453(Vol.5) | 20-43858 | |
| X-53453(Vol.6) | 20-43859 | |
| **NASA-TN–** | **(Misc.)** | |
| D-3546 | 20-43832 | CFSTI $1.00 cy, $0.50 mn |
| D-3610 | 20-43899 | CFSTI $2.50 cy, $0.50 mn |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **NBS-D–** | **(Misc.)** | |
| 150 | 20-43900 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 154 | 20-43901 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **NDL-TM–** | **(Non-AEC)** | |
| 32 | 20-43986 | See AD-637937 |
| **NIJS-R–** | **(Yugoslavian)** | |
| 484 | 20-44647 | Dep. mn |
| **NMI–** | **(Misc.)** | |
| 7018 | 20-43902 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **NP–** | **(AEC File No. for Non-AEC Reports)** | |
| 15934 | 20-42999 | Dep. mn |
| 16148 | 20-45186 | |
| 16176 | 20-42847 | Dep. mn |
| 16179 | 20-43508 | Dep. mn |
| 16200 | 20-43549 | Dep. mn |
| 16214 | 20-43077 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 16216 | 20-43421 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 16224 | 20-42798 | Dep. mn |
| 16238 | 20-43903 | National Bureau of Standards Free |
| 16245 | 20-43581 | Dep. mn |
| 16256 | 20-42848 | Dep. mn |
| 16258 | 20-42849 | Dep. mn |
| 16265 | 20-42741 | Dep. mn |
| 16267 | 20-45239 | Dep. mn |
| 16272 | 20-45114 | Dep. mn |
| 16278 | 20-44177 | Dep. mn |
| 16280 | 20-44283 | Dep. mn |
| 16281 | 20-43799 | |
| 16291 | 20-44587 | Dep. mn |
| 16301 | 20-43175 | |
| 16302 | 20-43176 | |
| 16303 | 20-43177 | |
| 16310 | 20-44863 | Dep. mn |
| **NP-tr–** | **(AEC File No. for Non-AEC Translations)** | |
| 1419 | 20-44045 | Dep. mn. JCL $5.60 fs, $1.88 mf |
| **NRDC–** | **(British)** | |
| 117 | 20-44648 | Dep. mn |
| **NRL–** | **(Misc.)** | |
| 6394 | 20-43178 | |
| **NRL-AR–** | **(New Zealand)** | |
| 16 | 20-43581 | See NP-16245 |
| **NRL-Memo–** | **(Misc.)** | |
| 1663 | 20-43997 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **NSJ-tr–** | **(Japanese)** | |
| 53 | 20-42861 | Dep. mn. JCL $1.10 fs, $0.80 mf. JAERI |
| 54 | 20-43518 | Dep. mn. JCL $1.10 fs, $0.80 mf. JAERI |
| **NUMEC–** | | |
| 3428-23 | 20-43904 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **NYO–** | | |
| 844-67 | 20-43550 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 2043-130 | 20-42850 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 2082-6 | 20-43179 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 2150-19 | 20-44993 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 2373-1 | 20-42706 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 2955-7 | 20-43455 | See CONF-651114-3 |
| 3029-8 | 20-44566 | Solid State Commun., 4: 403-6(1966) |
| 3237-6 | 20-43481 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 3250-7 | 20-45115 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 3274-9 | 20-42851 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 3464-2 | 20-44994 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 3481-3 | 20-43022 | Advances Biol. Med. Phys., 10: 91-148 (1965) |
| 3558-6 | 20-43317 | J. Chem. Phys., 45: 2324-5(1966) |
| **ORNL–** | | |
| 3212 | 20-43905 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 3721 | 20-45216 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 3791 | 20-43422 | Dep. mn. CFSTI $4.00 cy, $1.00 mn |
| 3887 | 20-44649 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 3975 | 20-43078 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 3980 | 20-43805 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 3985 | 20-43582 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 3993 | 20-43998 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 3996 | 20-45116 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 3997 | 20-43180 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 4008 | 20-43806 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 4010 | 20-44864 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 4011 | 20-44865 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **ORNL-P–** | **(Misc.)** | |
| 13 | 20-44135 | Phys. Kondens. Mater., 5: 178-91(1966) |
| 1162 | 20-44002 | Acta Met., 14: 1201-12(1966) |
| 1623 | 20-43941 | J. Amer. Ceram. Soc., 49: 410-14(1966) |
| 1863 | 20-43947 | J. Chem. Eng. Data, 11: 392-4(1966) |
| 2042 | 20-44247 | Phys. Rev., 150: 243-8(1966) |
| 2114 | 20-43226 | J. Chem. Eng. Data, 11: 343-6(1966) |
| 2126 | 20-45217 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2130 | 20-44128 | J. Opt. Soc. Amer., 56: 1292-7(1966) |
| 2140 | 20-44122 | J. Chem. Phys., 45: 2227-32(1966) |
| 2168 | 20-44027 | Weld. J. (N. Y.), 45: 385s-91s(1966) |
| 2216 | 20-45030 | Phys. Status Solidi, 17: 27-33(1966) |
| 2233 | 20-43099 | Anal. Chem., 38: 1494-8(1966) |
| 2248 | 20-43818 | J. Appl. Phys., 37: 3910(1966) |
| 2311 | 20-45048 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2354 | 20-43423 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2359 | 20-43424 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2361 | 20-43906 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2387 | 20-43583 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2389 | 20-43460 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2406 | 20-43425 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2410 | 20-45204 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 2411 | 20-43584 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2412 | 20-44650 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2431 | 20-45049 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2432 | 20-43380 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2433 | 20-43381 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2434 | 20-44651 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2439 | 20-43181 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2467 | 20-43671 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 2468 | 20-44652 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2471 | 20-43672 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2472 | 20-43491 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2491 | 20-45205 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 2492 | 20-44030 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **ORNL-TM–** | | |
| 1030 | 20-43833 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1194 | 20-45117 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 1225 | 20-44720 | Nucl. Phys., 87: 138-40(1966) |
| 1260 | 20-45050 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1312(Vol.2) | 20-43492 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 1392 | 20-44995 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 1484 | 20-44588 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1505(Pt.2) | 20-43757 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1508 | 20-43182 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1519 | 20-43482 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1544 | 20-43999 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1571 | 20-44111 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 1574 | 20-44000 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1589 | 20-43585 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1590 | 20-43079 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1596 | 20-43907 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1612 | 20-43834 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1650 | 20-43426 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **ORNL-tr–** | | |
| 1228 | 20-45127 | Dep. mn. JCL $4.60 fs, $1.64 mf |
| 1266 | 20-44112 | Dep. mn. JCL $1.10 fs, $0.80 mf |
| 1289 | 20-42800 | Dep. mn. CFSTI $1.00 cy, $0.50 mn. JCL $1.60 fs, $0.80 mf |
| 1344 | 20-43186 | Dep. mn. JCL $5.60 fs, $1.79 mf |
| 1348 | 20-43456 | JCL $4.60 fs, $1.43 mf |
| **ORO–** | | |
| 2459-1 | 20-43013 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2669-2 | 20-42977 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2670-15 | 20-43080 | Dep. mn. CFSTI $4.00 cy, $1.00 mn |
| 2903-28 | 20-42852 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2907-2 | 20-43235 | J. Phys. Chem., 70: 3014-17(1966) |
| 2915-49 | 20-44721 | Nucl. Phys., 87: 153-69(1966) |
| 2968-21 | 20-43292 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 2980-13 | 20-43081 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 3191-1 | 20-45206 | Dep. mn. CFSTI $2.00 cy, $1.00 mn |
| 3299-1 | 20-42853 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **P–** | **(Misc.)** | |
| 3170(RAND) | 20-43566 | See AD-625251 |
| **PAN–** | **(Polish)** | **(This series of reports was terminated in 1965. Subsequent reports are identified by the code INR.)** |
| **PATENTS** | **(British)** | **(4s. 6d. each, U. K. Patent Office)** |
| 1,032,212 | 20-43474 | |
| 1,037,545 | 20-43475 | |
| 1,038,830 | 20-43409 | |
| 1,041,354 | 20-43053 | |
| 1,041,470 | 20-44172 | |
| **PATENTS** | **(Canadian)** | |
| 738,074 | 20-44068 | |
| **PATENTS** | **(German)** | |
| 1,216,274 | 20-43266 | |
| **PATENTS** | **(Japanese)** | |
| 1965-26960 | 20-44600 | |
| **PATENTS** | **(U. S.)** | **($0.50 each, U. S. Patent Office)** |
| 3,256,438 | 20-43163 | |
| 3,256,441 | 20-43476 | |
| 3,261,149 | 20-43751 | |
| 3,264,203 | 20-43379 | |
| 3,264,473 | 20-43796 | |
| 3,267,308 | 20-44170 | |
| 3,267,383 | 20-44067 | |
| 3,268,728 | 20-43054 | |
| 3,270,202 | 20-43748 | |
| 3,271,574 | 20-43749 | |
| 3,271,597 | 20-44171 | |
| **PE–** | **(Canadian)** | |
| 16 | 20-43465 | See AECL-2592 |
| **PEL–** | **(South African)** | |
| 116 | 20-43082 | Dep. mn |
| **PNE–** | | |
| 607F | 20-43461 | Dep. mn. CFSTI $1.50 cy, $0.50 mn |
| **PNRO-DEV–** | | |
| 136 | 20-43586 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **PPAD–** | | |
| 596-E | 20-43673 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **PUC–** | | |
| 937-219 | 20-44653 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 937-227 | 20-44654 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| **PWA–** | **(Non-AEC)** | |
| 2877 | 20-43816 | |
| **PWAC–** | **(Misc.)** | |
| 237 | 20-43908 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **R–** | **(Misc.)** | |
| 2376 | 20-43413 | See EURAEC-1659 |
| 66SD3012 | 20-43083 | |
| **RHEL/R–** | **(British)** | |
| 124 | 20-44043 | Dep. mn. BIS $0.60. HMSO 3s. 0d. |
| **RISO–** | **(Danish)** | |
| 91 | 20-43835 | Dep. mn. Danish Atomic Energy Commission, Risoe, Denmark |
| 125 | 20-45051 | Dep. mn. Danish Atomic Energy Commission, Risoe, Denmark |
| **RISO-M–** | **(Danish)** | |
| 434 | 20-45118 | Dep. mn |
| **RITU–** | | |
| 1966-18 | 20-43179 | See NYO-2082-6 |

| Report No. | Abstract No. | Availability |
|---|---|---|
| **RL-GEN–** | | |
| 1058 | 20-45191 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **RL-SEP–** | | |
| 712 | 20-43427 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 729(Rev.) | 20-43183 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 924 | 20-43428 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **RLO–** | | |
| 581-10 | 20-42707 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1388B-11 | 20-44773 | Phys. Lett., 22: 495-8(1966) |
| 1751-2 | 20-42731 | Dep. mn. CFSTI $4.00 cy, $1.00 mn |
| **RM–** | **(Misc.)** | |
| 4968-TAB | 20-43587 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 4989-TAB | 20-43510 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 5090-TAB | 20-43588 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **RPI–** | **(Misc.)** | |
| 3639-1 | 20-43483 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **RT-CHI–** | **(Italian)** | |
| (66)1 | 20-43301 | Chim. Ind. (Milan), 47: 1060-4(1965) |
| (66)3 | 20-43210 | Gazz. Chim. Ital., 95: 997-1005(1965) |
| (66)4 | 20-43211 | Gazz. Chim. Ital., 95: 1006-20(1965) |
| (66)5 | 20-43212 | Gazz. Chim. Ital., 95: 1021-30(1965) |
| **RT-PROT–** | **(Italian)** | |
| (65)6 | 20-45220 | Ing. Sanit., No. 3, 1-8(1964) |
| (65)34 | 20-43600 | Folia Med. (Naples), 48: 73-87(1965) |
| **S–** | **(Misc.)** | |
| 333 | 20-44587 | See NP-16291 |
| **SAN–** | | |
| 651-1 | 20-43497 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **SC-DC–** | | |
| 66-1821 | 20-43755 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 66-1888 | 20-43909 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 66-1890 | 20-44943 | Phys. Rev. Lett., 17: 623-6(1966) |
| **SC-RR–** | | |
| 66-376 | 20-45240 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| **SC-TM–** | | |
| 65-135 | 20-45241 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **SGAE-CH–** | **(Austrian)** | |
| 35/1966 | 20-43860 | Dep. |
| **SGAE-M–** | **(Austrian)** | |
| 5/1966 | 20-43860 | See SGAE-CH-35/1966 |
| **SLAC-PUB–** | | |
| 183 | 20-43711 | Nucl. Instrum. Methods, 44: 317-20(1966) |
| 199 | 20-43634 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **SM–** | **(Misc.)** | |
| 76-13 | 20-43672 | See ORNL-P-2471 |
| 76-67 | 20-43671 | See ORNL-P-2467 |
| **STI-DOC–** | **(International Atomic Energy Agency)** | |
| 10/54 | 20-43760 | IAEA: $4.00; S84,-; £ 1.4.0; F Fr 16,-; DM 14 |
| **STI-PUB–** | **(International Atomic Energy Agency)** | |
| 21/19 | 20-43055 | IAEA: $5.00; S105,-; £ 1.10.0; F Fr 20,-; DM 17,50 |
| 113 | 20-42742 | IAEA: $5.00; S105,-; £ 1.10.0; F Fr 20,-; DM 17,50 |
| 118 | 20-43589 | IAEA: $3.00; S63,-; 18/-stg; F Fr 12,-; DM 10,50 |
| **STL–** | **(Misc.)** | |
| 372-38 | 20-43484 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **SWRI–** | | |
| 1228-7-34 | 20-45119 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1228-7-35 | 20-45120 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **SZS–** | **(German)** | |
| 4/66 | 20-44655 | Dep. mn |
| **TID–** | | |
| 8200(14th Rev.) | 20-45052 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 12860 | 20-43861 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 17070 | 20-43836 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 22680 | 20-44310 | J. Math. Phys., 7: 1670-9(1966) |
| 22762 | 20-43320 | J. Phys. Chem., 70: 2951-5(1966) |
| 22856 | 20-44251 | Phys. Rev. Lett., 17: 603-5(1966) |
| 22931 | 20-42708 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 22978(Rev.) | 20-45242 | Dep. mn. CFSTI $4.00 cy, $1.00 mn |
| 23104 | 20-43939 | Inorg. Chem., 5: 1563-7(1966) |
| 23127 | 20-42854 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23203 | 20-42855 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23213 | 20-42856 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 23223 | 20-43677 | Appl. Phys. Lett., 9: 227-30(1966) |
| 23228 | 20-42857 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23233 | 20-42709 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23269 | 20-43910 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23295 | 20-43084 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 23312 | 20-43862 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23315 | 20-44656 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 23319 | 20-43838 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 23320 | 20-45121 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23321 | 20-45122 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23338 | 20-45123 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 23339 | 20-45124 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 23342 | 20-43090 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 23343 | 20-43467 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| 23344 | 20-43468 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 23348 | 20-42710 | CFSTI $3.00 cy, $0.50 mn |
| 23350 | 20-43469 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **TIM–** | **(Misc.)** | |
| 823 | 20-43837 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| **TRG-Report–** | **(British)** | |
| 996 | 20-44020 | Phil. Mag. (8), 14: 343-56(1966) |
| 1104 | 20-44018 | Phil. Mag. (8), 14: 317-23(1966) |
| 1169 | 20-45179 | See CONF-651132-8 |
| **TT–** | **(Canadian)** | |
| 66-33149 | 20-43817 | See JPRS-36718 |
| 66-33373 | 20-43056 | See JPRS-36943 |
| **UCB–** | **(Misc.)** | |
| 34P95-1 | 20-42799 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **UCD-CNL–** | | |
| 46 | 20-44065 | Rev. Sci. Instrum., 37: 1390-4(1966) |
| **UCOL–** | **(Misc.)** | |
| 535-556 | 20-44692 | Can. J. Phys., 44: 2095-2110(1966) |
| **UCRL–** | | |
| 6262(Pt.1) | 20-43911 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 7879 | 20-43464 | Amer. Mineral., 51: 1192-9(1966) |
| 12484(Rev.2) | 20-43635 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 13225 | 20-43462 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 14289 | 20-43076 | See NAS-NS-3058 |
| 14455 | 20-44957 | Rev. Sci. Instrum., 37: 1354-9(1966) |
| 14467-T(Rev.1) | 20-44910 | J. Chem. Phys., 45: 2102-21(1966) |
| 14625(Rev.1) | 20-45243 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 14631 | 20-42743 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 14707 | 20-43590 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 14743 | 20-43470 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 14756 | 20-43463 | Dep. mn. CFSTI $2.00 cy, $0.75 mn |
| 14859 | 20-43912 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 14867 | 20-44725 | Nucl. Phys., 88: 513-22(1966) |
| 14879 | 20-43091 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 14993 | 20-43636 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 16246 | 20-42711 | Dep. mn. CFSTI $5.00 cy, $1.00 mn |
| 16256 | 20-43913 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 16602 | 20-44657 | Dep. mn. CFSTI $4.00 cy, $0.75 mn |
| 16619 | 20-43914 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| 16714 | 20-43735 | Rev. Sci. Instrum., 37: 1385-90(1966) |
| 16740 | 20-44052 | J. Appl. Phys., 37: 3875-83(1966) |
| 16761 | 20-43915 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 16878 | 20-43514 | Dep. mn. CFSTI $2.00 cy, $0.75 mn |
| 16881 | 20-44178 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| 16912 | 20-44250 | Phys. Rev. Lett., 17: 599-603(1966) |
| 16922 | 20-43916 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |

| Report No. | Abstract No. | Availability |
|---|---|---|
| 16934 | 20-44224 | Phys. Lett., 22: 524-5(1966) |
| 16984 | 20-44658 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 16990 | 20-44659 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 17026 | 20-44504 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 17064 | 20-43184 | ORAU |
| 70002 | 20-44660 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 70018 | 20-43638 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 70025 | 20-44866 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 70026 | 20-44867 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 70027 | 20-44868 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **UCSD–** | | |
| 10P10-6 | 20-44366 | Phys. Lett., 22: 692-5(1966) |
| **UNC–** | **(Misc.)** | |
| 5139 | 20-44661 | CFSTI $6.00 cy, $1.25 mn |
| **UR–** | | |
| 49-687 | 20-42718 | Dep. mn. CFSTI $6.00 cy, $1.25 mn |
| 875-141 | 20-44728 | Nucl. Phys., 88: 539-47(1966) |
| 875-155 | 20-44345 | Nuovo Cimento (10), 45A: 505-9(1966) |
| **USBM-RC–** | | |
| 1113 | 20-43917 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **USC–** | | |
| 136-111 | 20-44662 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **USNRDL-TR–** | **(Misc.)** | |
| 1024 | 20-42831 | See AD-635600 |
| 1029 | 20-42830 | See AD-635598 |
| 1038 | 20-44987 | See AD-637685 |
| 1042 | 20-43592 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **USNRDL-TRC–** | **(Non-AEC)** | |
| 16(Summary) | 20-43567 | See AD-635820 |
| 44 | 20-43752 | See AD-635589 |
| **UU–** | **(Non-AEC)** | |
| 66-9 | 20-43667 | See AD-639694 |
| **VUF–** | **(Misc.)** | |
| 3015 | 20-43551 | Dep. mn. CFSTI $1.50 cy, $0.75 mn |
| **WANL-TME–** | **(Misc.)** | |
| 1472 | 20-44589 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **WAPD-PWR–** | | |
| TE-203 | 20-45125 | Dep. mn. CFSTI $3.00 cy, $0.50 mn |
| **WAPD-T–** | | |
| 1802 | 20-44590 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| 1865 | 20-44019 | Phil. Mag. (8), 14: 335-42(1966) |
| **WAPD-TM–** | **(Misc.)** | |
| 571 | 20-44663 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **WCAP–** | **(Misc.)** | |
| 2948 | 20-45115 | See NYO-3250-7 |
| 2972 | 20-45097 | |
| 3374-4 | 20-45098 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| 6072 | 20-45126 | Dep. mn. CFSTI $3.00 cy, $0.75 mn |
| **Y–** | | |
| 1175(Del.) | 20-43089 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1290 | 20-43863 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1550 | 20-43864 | Dep. mn. CFSTI $2.00 cy, $0.50 mn |
| 1553 | 20-43092 | Dep. mn. CFSTI $1.00 cy, $0.50 mn |
| **Y-DA–** | | |
| 523 | 20-43202 | Chem. Eng. Progr., Symp. Ser., Pt. 15, 62: 43-51(1966) |
| **ZFK-WF–** | **(German)** | |
| 25 | 20-43185 | Dep. mn |

ARG
B

AUS
C
Su

AUS
Vi

BEL
Mo
I
BOLI
La
BRAZ
Ric
E
São
C
BURM
Ran
In
CANA
Ham
Otta
Vanc
CHILE
Sant
Ur
CHINA
Hsin
Hu
COLOM
Bogo
COSTA
San P
DENMA
Risö,
ECUAD
Quito,
EL SAL
San Sa
Bib
FINLAN
Helsin
FRANCE
Gif-sur
Sacl
Paris,
GERMAN
Berlin,
Berli
Frankfu
Munich

AUSTRIA
Vienna
BELGIUM
Bruss

# DEPOSITORIES OF USAEC REPORTS

## In Countries Other than the U.S.

- **ARGENTINA**
  - Buenos Aires, Comisión Nacional de Energía Atómica
- **AUSTRALIA**
  - Canberra, Australian National Library
  - Sutherland, New South Wales, Australian Atomic Energy Commission
- **AUSTRIA**
  - Vienna, Zentral Bibliothek der Physikalischen Institute der Universität
- **BELGIUM**
  - Mol-Donk, Centre d'Etude de l'Energie Nucleaire
- **BOLIVIA**
  - La Paz, Comisión Nacional de Energiá Nuclear
- **BRAZIL**
  - Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao
  - São Paulo, Instituto de Energia Atomica, Cidade Universitaria São Paulo
- **BURMA**
  - Rangoon, Union of Burma Applied Research Institute, Atomic Energy Center Library
- **CANADA**
  - Hamilton, McMaster University
  - Ottawa, National Research Council Library
  - Vancouver, University of British Columbia
- **CHILE**
  - Santiago, Departamento de Fisica, Universidad de Chile
- **CHINA**
  - Hsinchu, Taiwan, Free China, National Tsing Hua University
- **COLOMBIA**
  - Bogota, Instituto De Asuntos Nucleares
- **COSTA RICA**
  - San Pedro, University of Costa Rica Library
- **DENMARK**
  - Risö, Danish Atomic Energy Commission
- **ECUADOR**
  - Quito, Escuela Politécnica Nacional
- **EL SALVADOR**
  - San Salvador, Universidad de El Salvador, Biblioteca de Energia Nuclear
- **FINLAND**
  - Helsinki, Teknillisen Korkeakoulun Kirjasto
- **FRANCE**
  - Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
  - Paris, Académie des Sciences
- **GERMANY**
  - Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
  - Frankfurt/Main, Gmelin-Institut
  - Munich, Technische Hochschule, Bibliothek
- **GHANA**
  - Accra, University College of Ghana
- **GREECE**
  - Athens, Nuclear Research Center "Democritus"
- **GUATEMALA**
  - Guatemala, Comisión Nacional de Energía Nuclear
- **INDIA**
  - Bombay, Department of Atomic Energy
- **IRAN**
  - Tehran, Tehran University Nuclear Centre
- **IRAQ**
  - Baghdad, Iraqi Atomic Energy Commission
- **IRELAND**
  - Dublin, University College
- **ISRAEL**
  - Rehovoth, Israel Atomic Energy Commission
- **ITALY**
  - Rome, Centro di Studi Nucleari della Casaccia
  - Rome, Comitato Nazionale per l'Energia Nucleare
- **JAPAN**
  - Tokyo, National Diet Library
- **KOREA**
  - Seoul, Office of Atomic Energy
- **LEBANON**
  - Beirut, Lebanese National Council for Scientific Research
- **LUXEMBOURG**
  - Luxembourg, Ministry of Transport and Electricity
- **MALAYSIA**
  - Kuala Lumpur, University of Malaysia
- **MEXICO**
  - Mexico, D.F., Comisión Nacional de Energía Nuclear
- **NETHERLANDS**
  - The Hague, Reactor Centrum Nederland
- **NEW ZEALAND**
  - Lower Hutt, Institute of Nuclear Sciences
- **NIGERIA**
  - Ibadan, University of Ibadan
- **NORWAY**
  - Lilleström, Institutt för Atomenergi
- **PAKISTAN**
  - Islamabad, Pakistan Institute of Nuclear Science and Technology
- **PERU**
  - Lima, Junta de Control de Energia Atomica
- **PHILIPPINE REPUBLIC**
  - Manila, Philippine Atomic Energy Commission
- **POLAND**
  - Warsaw, Biura Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej
- **PORTUGAL**
  - Sacavem, Junta de Energía Nuclear
- **REPUBLIC OF SOUTH AFRICA**
  - Pretoria, Atomic Energy Board Library
- **REPUBLIC OF THE CONGO**
  - Leopoldville, Université Lovanium
- **SPAIN**
  - Madrid, Junta de Energía Nuclear, Biblioteca Documentación y Publicaciones, Ciudad Universitaria
- **SWEDEN**
  - Nyköping, Aktiebolaget Atomenergi
- **SWITZERLAND**
  - Zürich, Eidgenössische Technische Hochschule, Bibliothek
- **THAILAND**
  - Bangkok, Office of the Thai Atomic Energy Commission, Department of Science
- **TURKEY**
  - Ankara, Turkish Atomic Energy Commission, Atomic Energy Library
- **UNITED ARAB REPUBLIC**
  - Cairo, Atomic Energy Commission
- **UNITED KINGDOM**
  - Birmingham, Central Library
  - Boston Spa, National Lending Library for Science and Technology
  - Kingston upon Hull, Central Library
  - Liverpool, Central Library
  - London, Central Library, Acton
  - London, National Reference Library
  - London, Science Museum Library, South Kensington
  - Manchester, Central Library
  - Newcastle upon Tyne, Central Library
  - Nottingham, Central Library
  - Sheffield, Central Library
- **URUGUAY**
  - Montevideo, Comision Nacional de Energia Atomica
- **VENEZUELA**
  - Caracas, Instituto Venezolano de Investigaciones Científicas
- **VIET-NAM**
  - Saigon, Atomic Energy Office
- **YUGOSLAVIA**
  - Belgrade, Federal Commission for Nuclear Energy

## In International Agencies

- **AUSTRIA**
  - Vienna, International Atomic Energy Agency
- **BELGIUM**
  - Brussels, La Bibliotheque EURATOM
- **FRANCE**
  - Paris, European Nuclear Energy Agency, O.E.C.D.
- **ITALY**
  - Ispra, EURATOM Research Center
- **SWITZERLAND**
  - Geneva, United Nations Library

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON, D.C. 20402

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. GOVERNMENT PRINTING OFFICE

# TECHNICAL PROGRESS REVIEWS

The Division of Technical Information, U. S. Atomic Energy Commission, also publishes the Technical Progress Reviews, a series of four quarterly journals on nuclear technology. These journals, compiled by specialists and recognized authorities, summarize, evaluate, and reference the progress of development in four important fields.

**Isotopes and Radiation Technology** P. S. Baker, A. F. Rupp, and associates, Oak Ridge National Laboratory. Reviews AEC-sponsored projects and related significant worldwide developments in radioisotopes and radiation technology.

**Nuclear Safety** Wm. B. Cottrell, W. H. Jordan, J. P. Blakely, and associates, Nuclear Safety Information Center, Oak Ridge National Laboratory. Covers topics relevant to the analysis and control of hazards associated with nuclear reactors and with operations involving fissionable materials and the products of nuclear fission.

**Power Reactor Technology** Argonne National Laboratory. Reviews research, development, design practices, and operating experiences associated with power reactors, including aerospace applications.

**Reactor Materials** E. M. Simons and associates, Battelle Memorial Institute. Covers the properties, behavior, and fabrication processes of materials used in nuclear reactors and associated equipment.

## Availability

*SUBSCRIPTION RATE:* The Technical Progress Reviews may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. *Nuclear Safety* at $3.00 per year for each subscription or $1.00 per issue; each of the other journals at $2.50 per year or $0.70 per issue.

*POSTAGE:* Postpaid within the United States, Canada, Mexico, and all Central and South American countries except Argentina, Brazil, Guyana, French Guiana, Surinam, and British Honduras. For these Central and South American countries and all other countries, add $0.75 for each annual subscription or $0.20 for a single issue.

*REMITTANCE:* Payment should be by check, money order, or document coupons and MUST accompany order. Remittances from foreign countries should be made by international money order or draft on an American bank payable to the Superintendent of Documents or by UNESCO book coupons.

FICE

al
ed
e-

t of
per
.70

can
ese
tion

pany
n an